

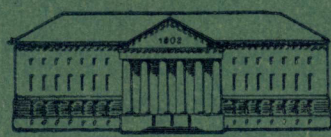
P A-1169

TRANSACTIONS OF THE TARTU STATE
UNIVERSITY
TARTU RIIKLIKU ÜLIKOOLI TOIMETISED
УЧЕННЫЕ ЗАПИСКИ
ТАРТУСКОГО ГОСУДАРСТВЕННОГО УНИВЕРСИТЕТА
ALUSTATUD 1893. a. VIINIK 156 ВЫПУСК ОСНОВАНЫ в 1893 г.

**PUBLICATIONS ON GEOGRAPHY
GEOGRAAFIA-ALASEID TÖID
ТРУДЫ ПО ГЕОГРАФИИ**

IV

ON THE OCCASION OF THE
XXTH INTERNATIONAL GEOGRAPHICAL CONGRESS
PÜHENDATUD
XX RAHVUSVAHELISELE GEOGRAAFIA KONGRESSILE
ПОСВЯЩЕННЫЙ
XX-му МЕЖДУНАРОДНОМУ ГЕОГРАФИЧЕСКОМУ КОНГРЕССУ



TARTU 1964

XVI
-9
Pöytäkirja 1169
A
TRANSACTIONS OF THE TARTU STATE
UNIVERSITY

TARTU RIIKLIKÜ ÜLIKOOLI TOIMETISED

УЧЕННЫЕ ЗАПИСКИ

TARTUSKOJO GOсударственного УНИВЕРСИТЕТА

ALUSTATUD 1893. a.

VIHİK 156 ВЫПУСК

ОСНОВАНЫ в 1893 г.

PUBLICATIONS ON GEOGRAPHY
GEOGRAAFIA-ALASEID TÖID
ТРУДЫ ПО ГЕОГРАФИИ

•IV•

ON THE OCCASION OF THE
XXTH INTERNATIONAL GEOGRAPHICAL CONGRESS

PÜHENDATUD
XX RAHVUSVAHELISELE GEOGRAAFIA KONGRESSILE

ПОСВЯЩЕННЫЙ
XX-му МЕЖДУНАРОДНОМУ ГЕОГРАФИЧЕСКОМУ КОНГРЕССУ

TARTU 1964

Editorial board:

L. Aru, V. Masing, S. Nõmmik, A. Perk, H. Remm, A. Rõõmusoks
and E. Varep (editor).

Redaktsioonikolleegium:

L. Aru, V. Masing, S. Nõmmik, A. Perk, H. Remm, A. Rõõmusoks
ja E. Varep (toimetaja).

Редакционная коллегия:

Л. Ару, В. Мазинг, С. Ныммик, А. Перк, Х. Ремм, А. Рыму-
окс и Э. Вареп (редактор).

N

Tartu Riikliku Ülikooli
Raamatukogu
87672

THE LANDSCAPE REGIONS OF ESTONIA

E. Varep

The first attempt to determine the landscape regions in Estonia was made in 1922 by Professor J. G. Granö who at that time occupied the Chair of Geography at Tartu University.¹ Using the method of cartographical synthesis he distinguished as many as 35 landscape units on the territory of Estonia. Many of these are acceptable and the division brings out well their distinctive features. But unfortunately this cannot be said of the scheme as a whole, which rests on a comparatively slender factual basis and fails to take into account the genetic differences between the various landscapes and landscape groups.

Granö's division of the landscape regions of Estonia was adopted in the main by his pupil A. Tammekann, who later similarly served for a long period as Professor of Geography at Tartu University. In certain particulars, however, Tammekann added fresh materials and achieved greater accuracy, devoting closer attention to the problem of genesis. His great contribution was the division of Estonian territory into two major genetical regions: the Estonian Highlands (Upper Estonia) and the Estonian Lowlands (Lower Estonia).² A few years later, in 1933, Professor Tammekann published a specific study of Estonian landscape types. Taking Granö's pioneer work as his point of departure he distinguished between four basic types: flat areas, tablelands, striated country and broken hilly regions.³ These types, however, are of a purely morphological character and fail to convey the essential differences in local natural conditions.

During the years following the Second World War substantial progress has been made in the investigation of the Estonian land-

¹ J. G. Granö: Eesti maastikulisel üksused. Deutsches Referat: Die landschaftlichen Einheiten Estlands. «Loodus», Vol. I, No. 2—5 (Tartu, 1922), pp. 105—123, 193—216 and 258—281.

² A. Tammekann: Outlines of the Distribution of Population in Estonia. *Loodusuurijate Seltsi Aruanded*, Vol. XXXV (Tartu, 1929), pp. 372—379.

³ A. Tammekann: Eesti maastikutüübid. Referat: Die Landschaftstypen Estlands. *Loodusuurijate Seltsi Aruanded*, Vol. XXXIX (Tartu, 1932), pp. 1—21.

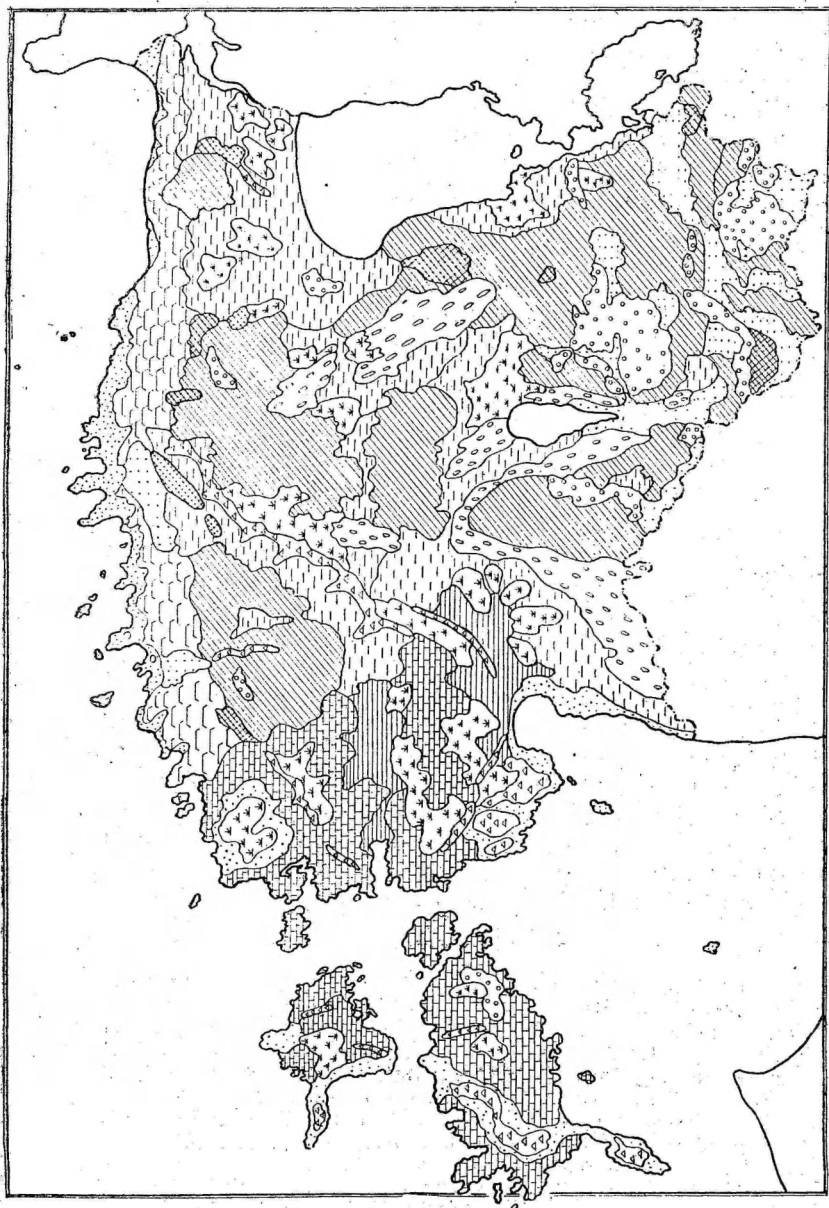


Fig. 1. The landscape types of Estonia.

1. Limestone plateau; 2. Limestone plains; 3. Moraine plains; 4. Moraine downlands; 5. Drumlin areas; 6. Sandy heathlands; 7. *Kames* areas; 8. Terminal moraines and oses (*õsar*); 9. Areas of sedimentary clays; 10. Forest covered lowlands, sites of former glacial lakes; 11. Sandy littoral and dune-lands; 12. Bogs and fens.

scapes. Researches of a particularly comprehensive nature have been devoted to a number of the smaller landscape units.⁴ In addition to these, detailed and extensive investigations into the geological origin, hydrographical network, climate, soils and vegetation of Estonia have been carried out. The majority of them have taken the geographical principle into account, and the results obtained furnish abundant materials for generalisation in the field of landscape science and have been utilised as a reliable basis for dividing the country into natural (physico-geographical) regions.⁵

The present paper constitutes an attempt to discuss certain general problems arising in connection with the landscape regions of Estonia. Only the most widespread types are considered, and special reference is made to their structure, genesis and intensity of economic exploitation. In so doing the author has based himself on his previously published scheme for the landscape regionalisation of Estonia,⁶ which he has attempted to expand and improve in a number of essential details.

The Division of Estonia into Basic Geographical Regions

As has been indicated above, it is possible to distinguish in Estonia, on the basis of their palaeogeographical evolution and present natural features, two basic geographical regions: Upper Estonia and Lower Estonia. The former of these has also been termed the supraquatic area, as opposed to the subaquatic area, which was inundated during the Late-glacial and Post-glacial periods by the water from glacial lakes and the Baltic Sea in various stages of its development.

Upper Estonia embraces the more elevated part of the territory, which was not flooded after the retreat of the continental ice. The few small lakes, which persisted only for a short while at the end of the Glacial period, did not exercise any decisive influence on the evolution of the natural conditions of the region. As compared with Lower Estonia, the relief is much more varied. In the supraquatic area the upper layer is mainly composed of

⁴ К. Т. Кильдема: Обзор исследований мелких географических комплексов в Эстонской ССР. Summary: A survey of the investigation of smaller geographical complexes in the Estonian S.S.R. *Zinātniskie Raksti*, Vol. XXXVII (Riga, 1961), pp. 363—375.

⁵ Э. Ю. Брик: Физико-географические районы Эстонской ССР. *Научные доклады высшей школы. Геолого-географические науки*, № 4 (Moscow, 1958), pp. 205—211. — *Idem*: Физико-географическое районирование Эстонской ССР. Zusammenfassung: Die physisch-geographische Einteilung der Estnischen Sozialistischen Sowjetrepublik. *Eesti NSV Teaduste Akadeemia Toimetised*, Vol. VIII, No. 2 (Tallinn, 1959), pp. 124—137.

⁶ Э. Ф. Вареп: Физико-географическое (ландшафтное) районирование Эстонской ССР. Summary: Geographical regions of the Estonian S. S. R. *Zinātniskie Raksti*, Vol. XXXVII (Riga, 1961), pp. 349—361.

Lower Estonia

I. North Estonia. 1. The Coastal Flats. 2. The Limestone Plateau. 3. The *Kõrvemaa* Area. 4. The District of Alutaguse.

II. West Estonia. 1. The Western Archipelago. 2. The West-Estonian Lowlands. 3. The Pärnu Lowlands. 4. Ruhnu Island.

III. The Basin of Lake Võrtsjärv

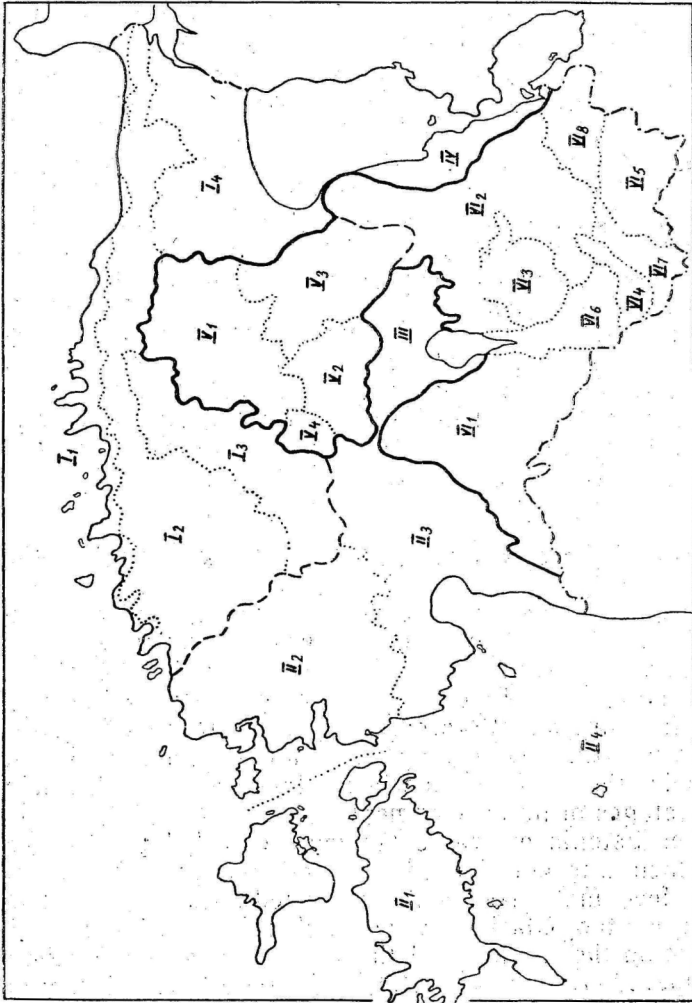
IV. The Basin of Lake Peipsi

Upper Estonia

V. The Estonian Watershed. 1. The Pandivere Uplands. 2. The Central Estonian Plain. 3. The *Vooremaa* (Drumlin) Area. 4. The Türi Drumlin Area.

VI. South Estonia. 1. The Sakala Uplands. 2. The South-East Estonian Plain. 3. The Otepää Heights. 4. The Kärula Hills. 5. The Haanja Heights. 6. The Väike-Emajõgi Vale and the Valga Basin. 7. The Hängla Basin and the Vale of Võru. 8. The *Paiunna* Area.

Fig. 2. The landscape regions of Estonia.



glacial sediments, the surface of which has produced a reasonably fertile soil cover in the course of time. We must also take into account the fact that the formation of the soils and vegetation lasted over a considerably longer period than in Lower Estonia, parts of which finally emerged from the sea in, from the geological point of view, quite recent times.⁷

The representative landscape types of Upper Estonia (Fig. 1) are undulating plains or moraine downlands, interspersed here and there with *sandur* areas. As a result of the relatively high productivity of the soils, farming is far more extensive than in Lower Estonia. This in its turn has given rise to a greater density of the rural population and a larger number of small urban-type settlements. Nevertheless it should not be forgotten that important differences exist between the various landscape types in the region as far as their agricultural potential is concerned.

Lower Estonia comprises the flatter coastal areas and the large inland depressions which, long after the retreat of the continental ice, remained inundated by the waters of glacial lakes and the Baltic Sea. The region eventually emerged as a result of the gradual uplift of the surface, a process which is continuing at the present day and is most marked in the extreme north-west corner of Estonia, though it has long since come to an end in the south-east. Marine deposits and the sediments of glacial lakes are distributed over the surface, rendering it more even and monotonous. As a result the relief is, generally speaking, level and continuous. Surface forms of marine origin occur frequently. The presence of numerous coastal barriers and chains of dunes running parallel with the beach has exerted an unfavourable effect on the natural drainage, and vast areas have become waterlogged. The soils are considerably less fertile than those of Upper Estonia, and the proportion of farmlands correspondingly smaller. On the other hand the subaquatic region is much richer in natural grasslands.

In spite of the flatness of the relief there is no lack of variety in the landscape types. Among the characteristic units of Lower Estonia we find limestone sheets with a thin soil cover, extensive coastal sandflats traversed by lines of dunes, densely forested areas of glacial lake sediments, and in certain districts extensive swamplands.

Neither Upper nor Lower Estonia constitute sharply differentiated regions complete in themselves. The physical characteristics of both are prolonged beyond the frontiers of Russia and Latvia respectively. On a European scale they should be regarded as minor geographical regions within the limits of the Baltic Area.

⁷ К. К. Орвику: Основные черты геологического развития территории Эстонской ССР в антропогенном периоде. *Eesti NSV Teaduste Akadeemia Toimetised*, Vol. IV, fasc. 2 (Tallinn, 1955), pp. 233—243.

In addition to the general features outlined above, the decisive factors on which any scheme for the geographical regionalisation of Estonia must be based are the geological structure of the ground rock and the nature and depth of the surface layer. In North, Central and West Estonia the bed is chiefly made up of carbonate rocks of the Ordovician and Silurian — limestones, dolomites and marls, and the ground moraine of the surface layer is consequently rich in calciferous materials.⁸ This in its turn has exercised a tremendous influence on the formation of the soils and vegetation.⁹ In South Estonia, on the other hand, the ground rock is mostly composed of Devonian sandstones, with the result that the cover is deficient in lime and calciferous soils are rare. These differences in geological structure are also reflected in the relief, which in the limestone areas is much less diversified and consequently far more even than in the outcrop areas of the Devonian sandstone. In addition to all this, North Estonia taken as a whole may be regarded as belonging to the abrasion area of the continental ice-sheet, whereas South Estonia belongs to the area of glacial accumulation, in which the surface layer may attain, or even exceed, a thickness of 100 metres. The intermediate region of Central Estonia is characterised by its wealth of drumlins.

Owing to the smallness of the territory climatic conditions do not play a role of any decisive importance in determining the geographical regions of Estonia, although the coastal zone, especially in the west, enjoys a somewhat more maritime climate than the inland areas.¹⁰

When we take into account all the above-mentioned considerations we find ourselves faced with the necessity of splitting up each of the major geographical units into a number of subregions (Fig. 2). Thus we divide Lower Estonia into four parts: North Estonia, West Estonia and the basins of the two large lakes

⁸ К. К. Орвику: Литологическое исследование морены последнего оледенения Эстонии количественными методами. Zusammenfassung: Lithologische Untersuchungen der in Estland vorkommenden Moränen der letzten Vereisung mit quantitativen Methoden. *Eesti NSV Teaduste Akadeemia Geoloogia Instituudi Urimused*, Vol. III (Tallinn, 1958), pp. 213—252.

⁹ A. Lillema: Eesti NSV muldade agronomiliste omaduste regionaal-seid erinevusi mullastikuvaldkondade lõikes. Резюме: О региональных особенностях агрономических свойств почв по почвенным районам Эстонской ССР. Zusammenfassung: Agronomische Eigenschaften der Böden der Estnischen SSR und ihre regionalen Verschiedenheiten je nach den Bodenrayons. *Eesti Geograafia Seltsi Aastaraamat 1962* (Tallinn, 1963), pp. 77—97. — See also L. Laasimer: Eesti NSV geobotaaniline rajoneerimine. Резюме: Геоботаническое районирование Эстонской ССР. Zusammenfassung: Geobotanische Gliederung der Estnischen SSR. (Tartu, 1958), p. 15.

¹⁰ K. Kirde: Kliima-valdkonnad Eestis. Zusammenfassung: Klimagebiete in Estland. *Acta et Commentationes Universitatis Tartuensis (Dorpatensis)*, Ser. A, Vol XXXVIII, fasc. 8 (Tartu, 1943). — See also Агроклиматический справочник по Эстонской ССР (Ленинград, 1960), pp. 24—30.

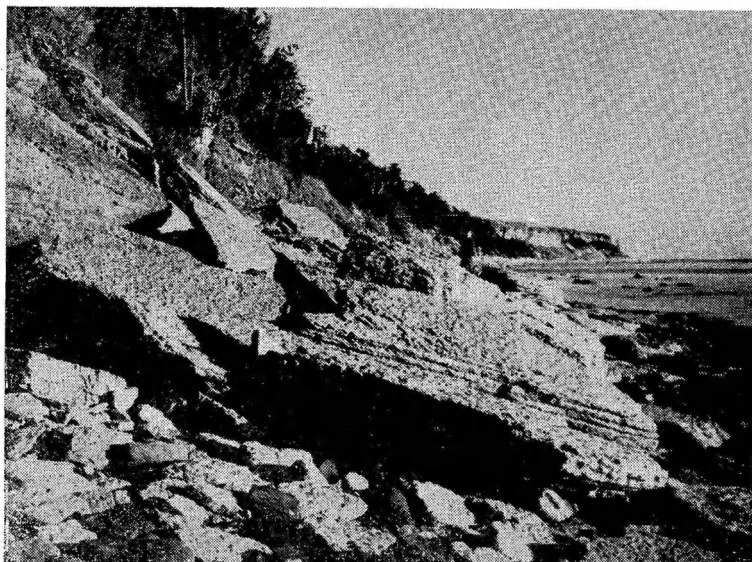


Fig. 3. Pakri Headland on the Glint.

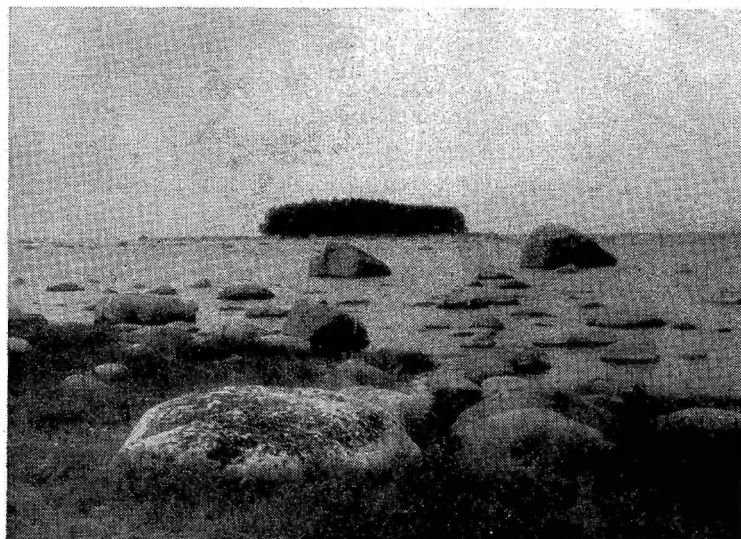


Fig. 4. Erratic glacial boulders at Käsnu on the North Coast.



Fig. 5. The Kõstivere karst area on the North Estonian Plateau.



Fig. 6. The Keila Falls on the edge of the Glint.

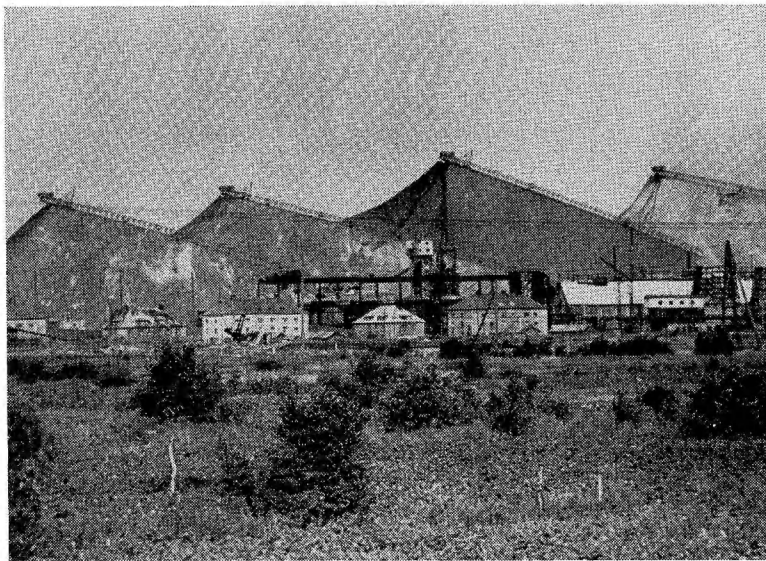


Fig. 7. Industrial landscape at Kohtla-Järve in North-East Estonia.

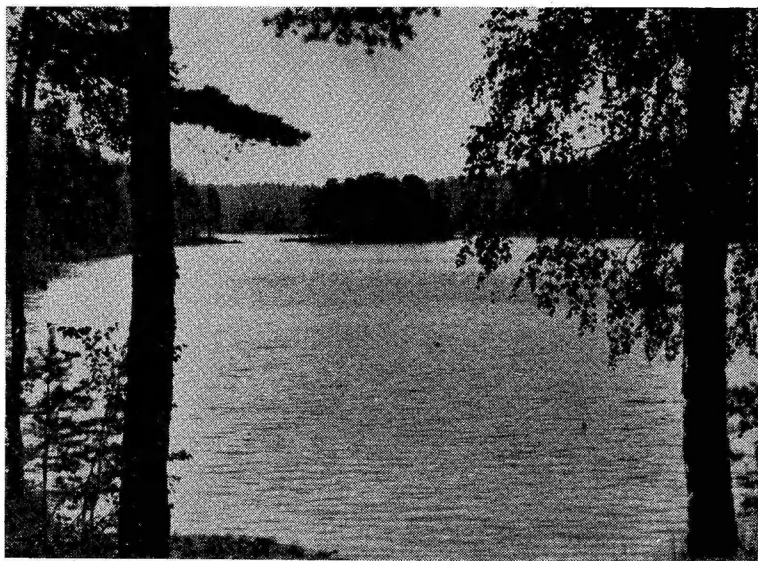


Fig. 8. Lake Viitna and its setting in a *sandur* area of North Estonia.

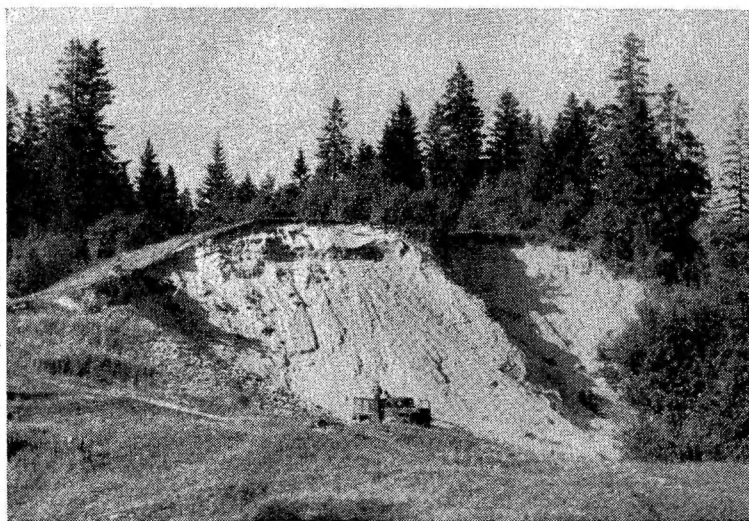


Fig. 9. The Jäneda ose (*ås*) in the Kõrvemaa Area.

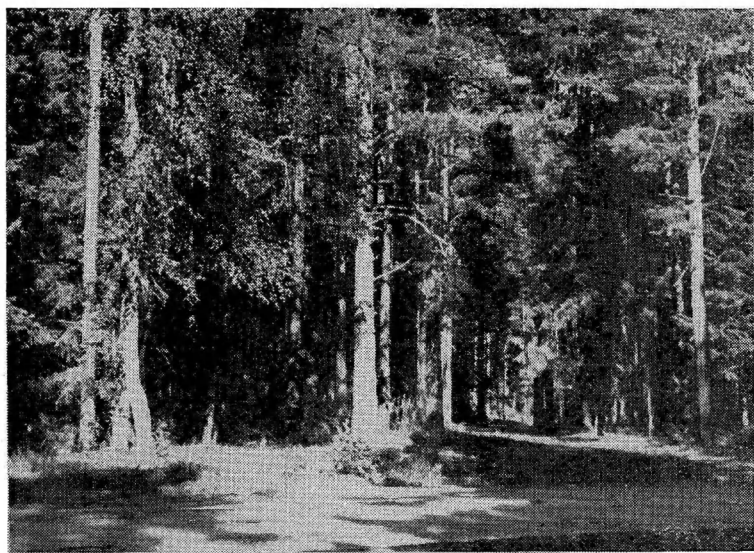


Fig. 10. The woods in the District of Alutaguse.

Võrtsjärv and Peipsi, while Upper Estonia falls into two distinct subregions, of which, following the example of Prof. Lippmaa, we name the northernmost one the Estonian Watershed,¹¹ and the other South Estonia. A brief discussion of the landscape types in each of these subregions, considered separately, will be found in the ensuing pages.

North Estonia

The region of North Estonia consists for the most part of the great limestone plateau ending abruptly at the steep edge of the Baltic Glint (Fig. 3), which runs along the southern shore of the Gulf of Finland. North of the Glint we have only the flat coastal strip, which includes the adjacent islands of Naissaar, Prangli and others. The coastal flats attain a maximum breadth of about 20 kilometres in the central sector of the North Coast, where they break up into numerous headlands (Fig. 4). Farther to the north-east (from Kalvi to Meriküla) the steep bank of the Glint reaches the sea. Only at the mouth of the R. Narva does the beach regain its former breadth. West of Tallinn the coastal strip is broken into isolated segments. The most westerly of the islands off the North Coast (Osmussaar Is. and the Pakri isles) must be regarded as detached fragments of the North-Estonian Plateau.

The **Coastal Flats of North Estonia** (I₁) originally formed part of the bed of the Finnish Gulf, and have only recently risen above sea level (for the most part not until after the Littorina stage) as a result of the general uplift of the earth's surface. From the geological point of view the coastal zone probably represents a deep erosional trough of great age, of which the ground rock (clays and sandstones of the Cambrium) has been worn deeply away in the course of time. The absolute height rarely exceeds 20 metres. The surface forms include flat sills of bedrock or glacial sediment pointing mostly towards the north-west. Here and there we find remnants of the plateau in the shape of abrupt table-like elevations.¹² The dominating elements, however, are the typical surface forms of marine origin — terraces, coastal barriers and sand dunes. The cover consists for the most part of stony moraine and shingles with marine sands especially at the mouths of the rivers. Stretches of marshland occur here and there, interspersed with a few coastal lakes. The chief soils are of podsolitic type.

¹¹ T. Lippmaa: Eesti geobotaanika põhijooni. Résumé: Aperçu géobotanique d'Estonie. *Acta et Commentationes Universitatis Tartuensis (Dorpatensis)*, Ser. A, Vol. XXVIII, fasc. 4 (Tartu, 1935), pp. 70—74.

¹² A. Tammekaann: The Baltic Glint. A geomorphological study. Part I: Morphography of the Glint. *Publicationes Instituti Universitatis Tartuensis Geographici* No. 24 (Tartu, 1940).

usually with sandy or extremely stony surfaces, and of low agricultural potentiality.¹³ The greater part of the zone is overgrown by coniferous forests. At the foot of the Glint, where the surface is moister, wooded meadows also occur, while the lower slopes are often covered by a dense growth of broad-leaved species. Only a tiny percentage of the land is under tillage; but in the immediate vicinity of Tallinn large numbers of market gardens are concentrated along the coastal strip, where the fine marine sands constitute highly suitable beds for the cultivation of vegetables.

The oldest inhabited centres on the North Coast sprang up on the sites of the landing places and fortified points. The most outstanding advantages of this type are enjoyed by Tallinn, which grew to be the largest town in Estonia already during the Middle Ages. The agricultural settlement of the coastal strip began here somewhat later than farther inland, not until the second half of the 13th century. Most of the settlements along the coast are fishing villages, which in the majority of cases are situated directly on the sea front. This tendency for the population to concentrate along the shoreline is particularly noticeable in the central sector of the North Coast, where the inner parts of the headlands are uninhabited and overgrown with forest. Of the smaller urban settlements on the coast, Paldiski (Baltisky) was founded in the 18th century, and throughout the whole time of its existence has served as an accessory harbour to Tallinn. The industrial centres of Kunda and Loksä have come into existence during the course of the last hundred years. The North Coast is dotted with holiday resorts, of which the most popular are Pirita, Rannamõisa, Keila-Joa and Klooga in the vicinity of Tallinn, Võsu and Kalvi in the middle sector, and Narva-Jõesuu in the far north-eastern corner of the republic.

The **North-Estonian Limestone Plateau** (I₂) embraces an extensive territory to the south of Tallinn. In an easterly direction the plateau extends as far as Narva, but is here markedly narrower, the overall breadth dwindling away in places to a mere strip of land only a few kilometres wide, though it is broader south of Kohtla-Järve. This area constitutes an exception in other respects. Whereas the plateau as a whole was inundated during the greater part of the Post-glacial period, we have here a stretch of high ground which was neither flooded by the overflow from glacial lakes nor directly by the sea, and which in origin actually forms part of Upper Estonia.

Along its northern edge the North-Estonian limestone plateau varies in height from 30 to 50 metres. Farther inland the surface

¹³ G. Vilberg: Põhja-Eesti saarte taimkattest [The vegetation of the North-Estonian islands] I., *Publicationes Instituti Tartuensis Geographici* No. 20 (Tartu, 1932).

gradually rises, attaining an average of 80 metres in the foothills of the Pandivere Uplands. In its general appearance the relief bears a comparatively even, smooth character. This impression is confirmed by the level stretches of calcareous rock and the flat projecting sills, which rarely exceed a height of 10 to 15 metres. At many points, particularly in the neighbourhood of the Glint, the limestone bedrock crops out on the surface, but for the most part it is covered by a thin layer (on an average ca. 1—2 metres thick) of calciferous moraine. Thus the relief is dominated by the flat forms produced by pre-glacial denudation of the bedrock and the action of the continental ice-sheet. In places the surface suggests the appearance of a series of terraces, while in others we seem to distinguish the characteristic hummocks of rock drumlins (e.g. in the vicinity of Keila). A few typical glacial land-forms — long lines of hilly terminal moraines, and the narrow, sinuous ridges of gravel and sand known as *åser* (oses, or *eskers*) — may be found scattered across the plateau. Other topographical forms (cliffs, coastal barriers, etc.) were produced by the action of the sea. In the valleys and interstitial depressions the surface is made up of sedimentary loams and sands, often covered by a rind of peat.¹⁴

The rich lodes of limestone in the North-Estonian Plateau have been quarried for centuries. Here, too (in the vicinity of the Glint), we find valuable deposits of phosphorite, which are mined at Maardu near Tallinn. The outcrops of the most important mineral wealth of Estonia — her vast beds of oil-shale — lie either within the boundaries of the north-eastern part of the plateau or its immediate vicinity. Mention should also be made of the peat reserves of the region, of which the consumption is steadily increasing from year to year.¹⁵

The drainage system in North Estonia possesses a number of distinctive features of uncommon occurrence. On the plateau the rivers that debouch in the Gulf of Finland flow mainly along shallow limestone beds and at a number of points disappear beneath the surface, giving rise to underground streams and other typical Karst phenomena (Fig. 5). But where they cut their way across the fens, or through surfaces of clay, sand or peat, the fall is slight and the current sluggish. Along the edge of the Glint the rivers of North Estonia form a remarkable series of falls (Fig. 6),

¹⁴ A. Таммеканн: Die Oberflächengestaltung des Nordostestländischen Küstentafellandes. *Acta et Commentationes Universitatis Dorpatensis*, Ser. A, Vol. IX, fasc. 7 (Tartu, 1926).

¹⁵ А. Марксоо: Проблемы формирования и развития северо-восточного экономического района Эстонской ССР. Zusammenfassung: Probleme der Formierung und Entwicklung des nordostestnischen Wirtschaftsgebietes. *Geograafja-alaseid töid. II. Tartu Riikliku Ülikooli Toimetised*, fasc. 128 (Tartu, 1962), pp. 35—141.

which supply the greater part of the potential water-power of Estonia, most of which is already derived from the hydroelectric station at Narva. At the foot of the falls the streams have cut deep gorge-type valleys, many of which are numbered among the most famous beauty spots in North Estonia. The plateau is poor in lakes, which are to be found only here and there in the heart of the larger swamps.

The soils distributed over the limestone bedrock of the Estonian Ordovician and Silurian outcrop area are characterised by their relatively high content of carbonate minerals. Gravels and shingles are common. Typical carbonate soils, grey in colour and clayey in composition, predominate in the higher ground, while gleyish drens are to be found in the moister areas. The carbonate soils are rich in humus and suitable in structure, but are frequently desiccated during the dry season. This is the case in particular with those soils that have been formed directly on the limestone base. These are the characteristic *alvar* areas, where only a thin rind of turf covers the ground rock.¹⁶ Such localities are of frequent occurrence in the neighbourhood of the Glint. They are usually overgrown with juniper bushes, and in many cases are used as pasturelands, though of poor quality. The characteristic appearance of the *alvar*-type landscapes surrounding Keila is due to the presence of the shrub *Dasyphora fruticosa*, which is almost ubiquitous in these parts, but occurs very rarely elsewhere in Estonia.¹⁷ The original *alvar* woodlands have survived in many places, and here and there, though very rarely, we find remnants of the ancient oak forests which were formerly widespread in the more fertile areas of the plateau. Throughout the whole of North Estonia there are extensive swamps and tracts of water-logged land, which are mainly used as hayfields. Most of these low-lying meadows were at one time left to run wild; but in a large number of cases they have since been cleared of trees and shrubs and utilised as pastures and hayfields. The proportion of cultivated land in the region is small (ca. 25 per cent of the total area), but the abundance of grasslands has created favourable conditions for the development of dairy farming, which has been further stimulated by the proximity of Tallinn and the industrial centres of the oil-shale basin.

The North-Estonian plateau was already densely populated in the distant past. We have historical data which testify to the fact that the majority of the old local settlements were already in

¹⁶ G. Vilberg: Loost ja lootaimkonnast Ida-Harjumaal. Referat: Die Alvare und die Alvarvegetation in Ost-Harrien. *Loodusuurijate Seltsi Aruanded*, Vol. XXXIV, fasc. 1 (Tartu, 1927).

¹⁷ G. Vilbaste: Põõsasmarana levikust Eesti NSV-s. Резюме: Распространение курильского чая в Эстонской ССР. *Loodusuurijate Seltsi juubelikoguteos* (Tallinn, 1953), pp. 154—169.

existence in the 13th century, and there is no lack of materials which enable us to trace their development from that time onwards.¹⁸ The population of the countryside is still relatively dense, and in addition a large number of urban centres have sprung up during the modern period. Of these we may mention the town of Keila, a satellite of Tallinn, the borough or municipality (Est. *alev*) of Rapla, and the industrial settlements of Maardu, Kehra and Kohila. In the north-east a remarkable group of young urban settlements has come into being in the mining and industrial region of the oil-shale basin (Fig. 7), which embraces the city of Kohtla-Järve (itself an agglomeration of urban settlements, including Kohtla, Kukruse, Jõhvi, Ahtme and Sompa), the towns of Sillamäe and Kiviõli, the borough of Püssi, the minor industrial centres of Aseri and Sonda, etc. The city of Narva, which is situated on the eastern frontier of the Estonian Republic, has also, in spite of its greater age, become a component element of this industrial region as a whole.

A touch of variety is added to the scenery of the North-Estonian plateau by the pine-grown sandy heaths which present themselves here and there. These are *sandur* areas originating from the end of the Glacial period (Fig. 8). One of them (Nõmme) stretches for about a score of kilometres to the south of Tallinn, and has become one of the chief residential districts of the capital. On the other hand a number of works producing building materials are concentrated here, the abundant sand deposits being utilised for the manufacture of silicalcite, the valuable new construction material. Another broad *sandur*-type area of heaths and pinewoods runs to the south and east from Kuusalu. In general this type of landscape is unsuitable for cultivation, and therefore sparsely populated.

The **Kõrvemaa Area** (I₃), which lies between the North Estonian plateau and the Pändivere Uplands, is characterised by a vastly different type of landscape. The word *kõrve* (i.e. "wasteland") was originally applied in Estonian to any area of wild, virgin forest,¹⁹ and to this day the region remains an area of extensive woods, fens and peatbogs. It is traversed by a series of long glacial ridges or *äsar* (Fig. 9), lying athwart the terminal moraines of the continental ice. The bedrock is covered in places by a thick layer of sands, thus giving rise to typical *sandur* landscapes, in others by the sediments of glacial lakes. Low elevations of the bedrock and groups of small drumlins with moraine surfaces

¹⁸ P. Johansen: Die Estlandliste des Liber Census Daniae (Kopenhagen — Reval, 1933).

¹⁹ J. Kents: Eesti «kõrve»-nimelised kohad — ürgse maastiku ja asustuse ilmeldajad. Резюме: Названия местностей со словом «кырб» — выразители древнего типа ландшафта и хода заселения Эстонской ССР. *Tartu Riikliku Ülikooli Toimetised. Geoloogia ja geograafia*, fasc. 2 (Tartu, 1947).

occur in only a few localities. The entire region is dotted with small lakes. The land is inadequately drained and many districts are in an advanced stage of paludification. On account of its predominant sandy or swampy soils the *Kõrvemaa* is sparsely populated. The largest centre is Aegviidu which, with its beautiful surroundings, has developed into a favourite holiday resort and tourist centre, especially for the inhabitants of the capital.

The **District of Alutaguse** (I₄) in North-East Estonia, which comprises the extensive territory stretching from the coastal plateau to the northern shore of Lake Peipsi, is in many respects analogous to the *Kõrvemaa* area. Here, too, the land was inundated at the end of the Glacial period by the melting continental ice, and the sediments of glacial lakes are distributed widely over the whole district. Farther to the west the limestone bedrock rises comparatively closer to the surface, thus producing a somewhat different type of soils and vegetation. The central part of the Alutaguse District is characterised by glacial ridges and rounded hills, which give rise to numerous lakes in the neighbourhood of Kurtna.²⁰ This part of the region, particularly the environs of Iisaku, is better provided with arable land and somewhat more densely populated. The area in the south was long flooded over by the water of Lake Peipsi, which is responsible for its present sandy surface. Fens and bogs, among them some of the largest in Estonia, occupy a large proportion of the area.

Of all the Estonian regions Alutaguse is richest in forests, some of which have retained their primeval character right up to the present day (Fig. 10), sheltering bears, large eagles, and a few other species, which if not absent in other parts of Estonia have at least become extremely rare. These forests are of considerable economic importance in so far as they supply the oil-shale basin with lumber.

The northern shore of Lake Peipsi is lined with dunes and sparsely populated by a few scattered fishing villages. In the north-west the dunes give way to a low, sandy beach — the fringe of the adjacent plain, which originally constituted the bed of the lake. The largest settlement in this sector of the littoral is Mustvee, which, thanks to its favourable situation in the network of communications, has grown from a mere fishing village into a small town.

West Estonia

West Estonia bears a certain resemblance in its landscapes to North Estonia. Indeed, it is difficult to draw a sharp line of demarcation between the two regions, as the North Estonian Plateau dips

²⁰ H. Riikojä: Zür Kenntnis einiger Seen Ost-Eestis, insbesondere ihrer Wasserchemie. *Loodusuurijate Seltsi Aruanded*, Vol. 46 (Tartu, 1940), pp. 196—232.

imperceptibly to merge with the West-Estonian Lowlands, while at the same time the transition between the *Kõrvemaa* area and the Pärnu Lowlands is no less gradual and indeterminate. The most typical part of West Estonia is the archipelago, which is cut off from the mainland by a network of straits and sounds. The island of Ruhnu in the middle of the Gulf of Riga must be regarded as constituting a district of its own.

West Estonia is the lowest part of the territory of the republic. It was long inundated by the sea and did not finally emerge from the water till after the Littorina stage. Marine deposits are scattered over the greater part of the region, and everywhere we meet with the typical surface forms produced by the action of the sea: beach barriers, terraces, maritime abrasion and accumulation plains, and long concatenations of sand dunes. The numerous coastal forms, which hinder the outflow of the water, have given rise to large numbers of swamplands and waterlogged areas. In addition to the foregoing we find — both in the archipelago and the West-Estonian Lowlands — level stretches of limestone similar to those which occur on the North-Estonian Plateau. One of the most characteristic landscape types is to be seen in the level plains of varved clays which are of particularly frequent occurrence in the river basins of the Kasari and Pärnu. In a few localities of West Estonia (the environs of Tõstamaa and Varbla, Kõpu headland, West Saaremaa and the Sõrve peninsula) we find considerable elevations, mostly wooded, of stony moraines and fluvio-glacial gravels.

The **West-Estonian Archipelago** (II₁) consists of the large islands of Saaremaa, Hiiumaa and Muhu, and a host of smaller islands (Fig. 11). There is no lack of variety in the scenery on Hiiumaa Is. (Ger. *Dagö*), where all the above-mentioned landscape types occur. In the eastern or north-western parts of the island we have limestone flats covered with dry meadowlands, which give place to hayfields and shrubby grasslands in the moister areas and to populous farmlands in the more fertile districts.²¹ The most populated section of the island is the environs of Käina, in the south-east, where there is an abundance of varved clay soils. The southern part of the island consists of low-lying flats of marine sands, and here the population is densest along the water front. Wooded meadows, copses, swamps and sandy heaths account for most of the central parts of the island. Sand dunes are common on the west coast and the headlands of Kõpu and Tahkuna, which are for the most part overgrown with trees and sparsely populated. However, there is a small moraine elevation in the middle of Kõpu

²¹ A. Lillmäa: Hiiumaa pinnakate ja mullastik [Surface layer and soils of Hiiumaa Is.], *Agrohoonia*, No. 1—2 (Tallinn, 1938), pp. 26—29 and 67—78.

headland, which has been partly cleared and brought under cultivation.

Saaremaa (Ger. *Oesel*), the largest island in the archipelago, is somewhat more uniform. Both it and the neighbouring island of Muhu are characterised by limestone sheets and flat elevations which in some places are entirely denuded, in others covered by a layer of shingly moraine.²² Saaremaa possesses large, hitherto only slightly utilised, reserves of pure limestone and dolomites. The soils are relatively unproductive, consisting for the most part of thin, very stony carbonate durns and gleys. However, all the surfaces that are in the least tillable have been turned to account and converted into fields which are surrounded for the most part by long walls of rough, loose stone. The environs of Põide and Valjala in the east, where the moraine cover is thicker, are somewhat more fertile. There are plentiful examples of *alvar* landscapes and wooded meadows, which on account of the calciferous surface are exceptionally rich in plant species and of great interest to the botanist. In some parts, as for example on the adjacent islet of Abruka, we find vestiges of the primeval deciduous forests, reminiscent of those in Central Europe and no less rich in species.²³ There are few swamps on the island, and those which occur are of comparatively recent origin.

In the high ground of West Saaremaa and the small local elevation of Sõrve Peninsula the landscape changes, and we find fluvio-glacial gravels and stony moraines that are in general ill-adapted for farming. Most of the surface is forested and the population is sparse. As a rule the high ground is encircled by lines of sand-dunes, often bordered on the other side by swamps and marshes.

Saaremaa Is. has been densely populated from time immemorial, in striking contrast with the neighbouring island of Hiiumaa, which as late as the 13th century is still referred to as void of inhabitants ("insula deserta") and which in the course of the succeeding centuries was populated mainly by settlers from Saaremaa and from the mainland. There are few settlements of an urban type on the islands. The chief town is Kingissepa (formerly Kuressaare) on the south-west coast of Saaremaa, which was chartered in the 16th century. Kärkla on Hiiumaa Is. did not make its appearance as a manufacturing centre till the 19th century.

The **West-Estonian Lowlands** (II₂) are for the most part a level plain on a bed of calcareous rock, rising slightly higher as it re-

²² Eesti VI. Saaremaa ["Estonia", a series published by the Committee for the Study of Local Lore, Vol. VI (The District of Saaremaa)] (Tartu, 1934).

²³ T. Lippmaa: Une analyse des forêts de l'île Estonienne d'Abruka (Abro) sur la base des associations unistrates. *Acta Instituti et Horti Botanici Universitatis Tartuenss*, Vol. IV, fasc. 1—2 (Tartu, 1935).

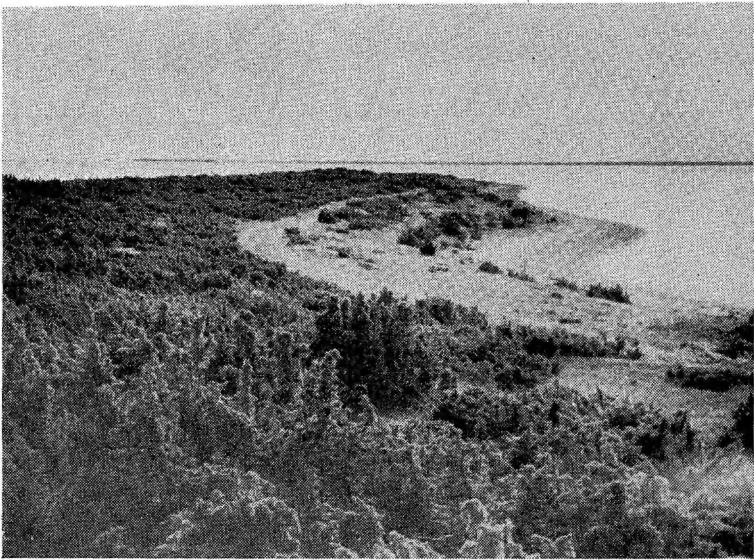


Fig. 11. Kassari Is. south-east of Hiiumaa.



Fig. 12. A landscape of West Estonia (Märjamaa).



Fig. 13. The banks of the R. Sauga in the Pärnu Lowlands.

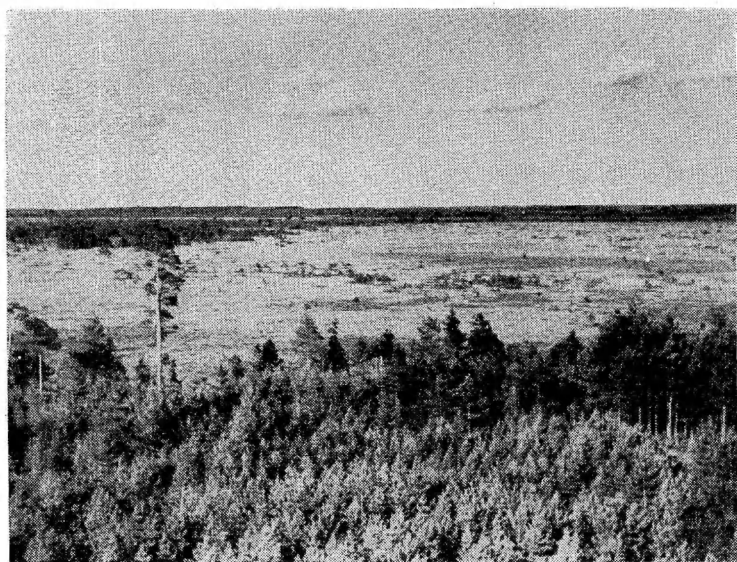


Fig. 14. View of the Tolkuse bog from the sand-dunes on the coast (to the south of Pärnu).



Fig. 15. The floodlands on the upper reaches of the R. Emajõgi in the Võrtsjärv Basin.

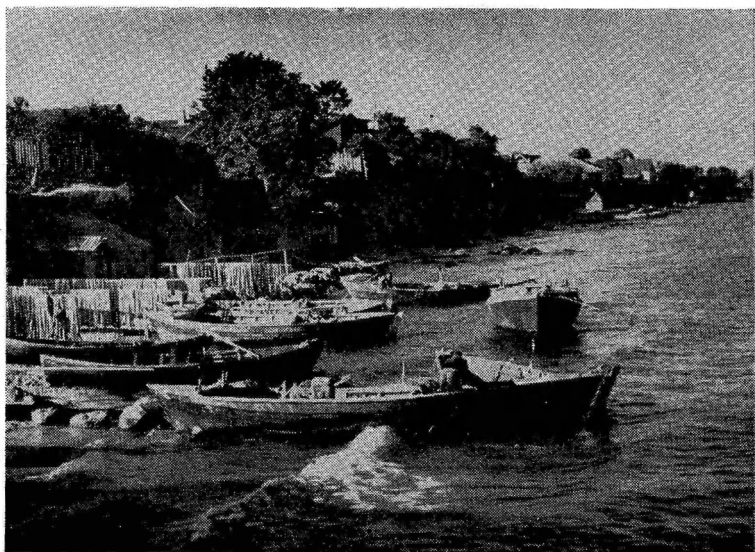


Fig. 16. Kallaste on the shore of Lake Peipsi.



Fig. 17. A view of the Pandivere Uplands from Kellavere Hill.



Fig. 18. Drumlin countryside at Elistvere (to the north of Tartu).

cedes from the coast. Cultivated areas with somewhat more fertile surfaces alternate with barren *alvars* and extensive water-meadows and swamps. This type of landscape is to be seen not only in the environs of Haapsalu, on Noarootsi Headland and the Island of Vormsi,²⁴ but also in the neighbourhood of Lihula and Pärnu-Jaagupi. On the other hand the country round Märjamaa (Fig. 12) is slightly higher, dry and rather more fertile, thus forming a transitional area connecting the Lowlands with the North-Estonian Plateau. This region has been inhabited from early times, and the villages, like those of Saaremaa, have to a certain extent preserved their patriarchal aspect till the present day.

The countryside round Vigala is different. Here we find a wide plain of varved clays, with only a few coastal barriers and remnants of projecting limestone. The plain is intersected by the river system of the Kasari basin, where the glacialacustrine and marine deposits are overlaid by fertile gley surface soils, which yield good crops when properly treated. The main problem here is that of draining the superfluous water. Since this is easier in the immediate vicinity of the rivers, the cultivated fields and rural population are mainly concentrated along the river banks, while swamplands and water-meadows stretch farther away to the rear. The settlement of the Kasari basin did not begin till about the middle of the 13th century, considerably later than in the limestone areas.

The northernmost part of the West-Estonian Lowlands, in the neighbourhood of Nõva, is a flat country of marine sands, where the limestone floor crops out at the surface in only one or two places. The area is traversed from north-west to south-east by long parallel glacial ridges, which are interconnected by curved rows of coastal formations. The resulting segments constitute large hollows, which are filled with broad swamplands and lakes. The whole area is thickly forested and the countryside is sparsely populated. Dense forests are also to be found in the environs of Eilamaa, Risti, and Palivere, which are intersected by a line of marginal accumulations left by the continental ice.

There are no large urban settlements in the West-Estonian Lowlands. The only town is Haapsalu, the administrative and economic centre of the region from early times. Among the local populated centres mention may be made of the boroughs of Lihula, Märjamaa and Pärnu-Jaagupi.

The **Pärnu Lowlands** (II₃), in the south-western extremity of the republic, exhibit certain points of difference with those of West Estonia as far as their natural conditions are concerned. The bedrock here mainly consists of Devonian sandstones, but in the course of time these have been deeply eroded and covered by a thick layer

²⁴ A. L a a s i: Ormsös landskapsbild. *Svio-Estonica* 1939 (Tartu, 1940), pp. 163—231.

of Quaternary deposits. Outcrops of the ground rock occur only here and there in the middle reaches of the R. Pärnu and the valleys of some other rivers. Varved clay surfaces are common in the centre of the lowlands, where well-cultivated fields mark the presence of fertile surface soils and the rural population is relatively dense (Fig. 13). But for the most part the Pärnu Lowlands are covered with sands, waterlogged or overgrown by woods. Extensive forested areas occur in the southern and north-eastern parts of the region. Apart from this large areas are in an advanced stage of paludification and extensive bogs are met with, especially along the north-western and eastern edges of the lowlands. In the north-west, where calciferous surfaces are occasionally to be found, there are abundant fens and grasslands.²⁵

Of the remaining parts of the Pärnu Lowlands, the country round Tõstamaa and Varbla is characterised by flattish drumlin-like elevations composed of extremely stony moraines. In the majority of cases they are forest-grown and are cultivated only in parts. The high ground is encircled by long lines of dunes, and the intermediate troughs are mostly occupied by lakes.

Similar concatenations of sand dunes (Fig. 14) follow the line of the beach, and the coastal strip is consequently barren. However, the seashore is densely populated by a whole string of fishing villages, which are mostly situated on the narrow belt of land only a few kilometres wide that runs between the sea and the line of dunes. During the last century the population has evinced a gradual tendency to encroach on the waterlogged areas behind the dunes, which have been partly drained and brought under cultivation.

The principal centre of population is the city of Pärnu, which is situated at the mouth of the river bearing the same name. Of the small urban-type settlements mention should be made of the industrial township of Sindi near Pärnu, and the boroughs of Vändra, Tootsi and Lavassaare, of which the two last are centres of the local peat industry.

Ruhnu Island (II₄) far out in the Gulf of Riga is similar in every essential respect to those off the mainland and with its sandy, mostly forest-grown surfaces supports a population of fishermen.

The Basins of Lakes Võrtsjärv and Peipsi

The third part of Lower Estonia consists of the region of the great lakes, which includes the basins of Võrtsjärv and Peipsi (Peipus). In both natural features and origin, these two regions

²⁵ T. Lippmaa: Beiträge zur Kenntnis der Flora und Vegetation Südwest-Estlands. *Acta Instituti et Horti Botanici Universitatis Tartuensis*, Vol. II, fasc. 3—4 (Tartu, 1932).

have so much in common that it is convenient to treat them jointly, in spite of the fact that they are situated in different parts of the country.

The **Basin of Lake Võrtsjärv (III)** in the centre of Estonia remained inundated for a long time during the Post-glacial period by the waters of the Glacial lake and the Greater Võrtsjärv lake which existed during the earlier Holocene.²⁶ As a result of the irregular rise of the earth's surface the greater part of the depression has by the present time been freed from water, and the lake itself is tending to settle gradually in the southern hollow of the dip. Round the upper reaches of the R. Emajõgi, in the lowest part of the basin, water-meadows and swamps (Fig. 15) are the rule, and the countryside is sparsely populated, except for a few isolated hamlets scattered along the banks of the river, or on some of the highest humps on the marshlands. Round the edge of the depression, especially in the north-east, there is an extensive forest belt. The population is here concentrated mainly along the rivers, where it is easier to drain off the superfluous water. The rural population is most concentrated in the area of small drumlins in the neighbourhood of Kolga-Jaani. The chief natural resources of the region are its reserves of timber and peat, the lake itself being only passably well supplied with fish.

The **Basin of Lake Peipsi (IV)**, of which only part belongs to Estonia, is much larger than that of Lake Võrtsjärv, but the general course of its evolution has been much the same. In early times the lake flooded a vast territory in excess of its present confines, particularly towards the north. Later the water retreated and large tracts of land emerged round the northern and north-western shores of the lake. Today the level of the lake is steadily rising in the whole of the south extremity, including Lake Pihkva (Pskov), with the result that the lower sectors of the shore are being reflooded and paludification is in full progress.²⁷

The northern part of the Peipsi depression links up directly with the District of Alutaguse, and has been dealt with above. The central sector of the western shore is more elevated and most of the land is farmed. The town of Kallaste, which is situated here on the high bank of Devonian sandstone overlooking the lake, is the centre of the Peipsi fishing industry (Fig. 16). Farther to the south, in the region of the mouth of the R. Emajõgi, the lake shore is lined by

²⁶ Л. Ф. Орвику: Новые данные о геологии озера Выртсъярв. Zusammenfassung: Neue Angaben über die Geologie des Sees Võrtsjärv. *Eesti NSV Teaduste Akadeemia Geoloogia Instituudi Uurimused*, Vol. III (Tallinn, 1958), pp. 269—293.

²⁷ A. Mieler: Ein Beitrag zur Frage des Vorrückens des Peipus an der Embachmündung und auf der Peipusinsel Piirisaare in dem Zeitraum von 1682 bis 1900. *Acta et Commentationes Universitatis Tartuensis*, Ser. A, Vol. IX, fasc. 2 (Tartu, 1926).

almost continuous marshes and swamps,²⁸ hemmed in by the broad expanses of forest on the slightly higher ground. Lake Pihkva (Pskov) is for the most part lined by water-meadows, which give way to extensive wooded heathlands stretching inland towards the south. Somewhat more fertile soils occur in the environs of the flourishing borough of Rāpina, on the lower reaches of the R. Võhandu, which in recent years has grown to be one of the major economic centres of the area.

The Estonian Watershed

The Estonian Watershed comprises the elevated ground in the northern and central parts of the country, where the bed is made up of carbonate rocks of the Ordovician and Silurian, and the surface layer mainly consists of rough calciferous tills. As a result the natural conditions are very similar to those of North Estonia, especially as concerns the geological structure and the quality of the soils, which are generally rich in lime. On the other hand, the area of the Watershed has many features in common with South Estonia, such as the relative lack of swamps, the superior natural fertility of the soils and the consequent wealth of farmlands; these points of resemblance being due to the fact that both subregions underwent a similar palaeogeographical evolution during the Late-glacial and Post-glacial periods.

The area of the Estonian Watershed attains its maximum height in the **Pandivere Uplands** (V_1), of which the foothills range between 60 and 80 metres, and the roof rises as high as 130 metres above sea level. This general limit is exceeded by a few isolated summits: Emumägi Hill (166 m.), Kellavere Hill (156 m.) and Ebaivere Hill (146 m.), all of which are of glacial origin.

The surface relief mainly takes the form of an undulating moraine plateau. Only rarely do we meet with flattish moraine hummocks, which add a touch of variety to the landscape. Large-sized drumlins occur on the southern fringe of the uplands, and similar formations, though somewhat smaller, may be found along the east and west borders. A highly distinctive feature is provided by the elongated oses (*āsar*), which frequently attain a length of several dozen kilometres. These are linked in places to groups of glacial buttes and other marginal forms. The Porkuni primeval valley traverses the heart of the uplands. Karst forms are fairly plentiful.

The Pandivere Uplands are made up of calcareous rocks of the Ordovician and Silurian, over which is spread a carbonate moraine

²⁸ V. Sirgo: Emajõe alamjooksul Peipsiäärsel madalikul asuvaist taimeühinguist. Summary: Plant Unions of the Swamps at the Mouth of the River Emajõgi. *Loodusuuriate Seltsi Aruanded*, Vol. XLII (Tartu, 1935), pp. 114—175.

cover from two to five metres thick, and the drumlins are usually overlaid with a coat of rough moraine shingle. Sandy surfaces appear only in the vicinity of the glacial ridges. The few swamps and marshes in the area are confined to the outskirts. Limestone beds constitute one of the principal natural resources, large kilns being operated at Tamsalu and Rakke.

The hydrography of the district is in many ways exceptional. On account of the extensive Karst areas in the centre of the highlands there is no permanent superficial network of streams. The water travels for long distances underground, and does not break the surface until it reaches the foothills. Here it emerges in the form of copious springs which rapidly grow into rivers flowing in all directions. The lakes are small, and in most cases associated either with the *åsar* or the terminal ridges marking the edge of the continental ice.

The predominant soils are fertile leached carbonate derno, which rank among the best in Estonia. The vast expanses of level or undulating arable lands create outstandingly favourable conditions for the mechanisation of agriculture (Fig. 17). Over fifty per cent of the surface is under cultivation. Natural grasslands are rare by comparison, occurring only in the damper parts of the foothills. On the fertile moraine plain there are a few scattered patches of forest, mainly well-developed spruce. The glacial ridges are generally also covered with woods. It is worthy of remark that the old oak forests still survive in several parts of the uplands, though in the rest of Estonia they are extremely rare. The largest forest area occurs on the ceiling of the high ground, east of Väike-Maarja, where the limestone bedrock rises almost to the surface.

The uplands are fairly densely populated, a characteristic feature being the presence of large rural settlements, the explanation for which must be sought in the disposition of the surface relief and the hydrographical network. There are repeated references in the chronicles to the prosperous villages with their broad expanses of cultivated fields, most of them dating back to as early as the 13th century. The two largest urban-type settlements are the towns of Rakvere and Tapa, of which the first is an important administrative centre, and the second a railway junction which sprang into prominence towards the end of the last century. The minor population centres include the boroughs of Ambla, Järva-Jaani and Tamsalu, and the market-towns of Väike-Maarja and Kadrina.

The **Central Estonian Plain** (V_2) stretches south of the Pandivere Uplands in the heart of Estonia and is gently tilted in the direction of the Võrtsjärv depression. In its natural conditions it differs little from the uplands themselves, being a wide undulating plain, scattered with occasional small drumlins and glacial ridges. A fertile calciferous moraine layer is spread over the limestone floor, which crops out at the surface at a few points only. Here, too,

fertile leachy carbonate soils predominate, and well-nigh half of the surface area is under cultivation. As in the Pandivere Uplands the prevailing forest types are sturdy spruce and mixed-spruce woods, which for the most part are scattered in the form of small copses surrounded by fields. Grasslands and fens are somewhat more numerous than in the uplands. On the whole the area is one of the most advantageous agricultural districts in Estonia. Dairy farming and, as a corollary, hog-raising for bacon were introduced here already at the very beginning of the present century, markedly earlier than in other parts of the country, and as a result an important meat combine came into being at Võhma. The countryside is rather densely populated, and there are a number of large-sized villages. The chief populated centre is the town of Põltsamaa.

Central Estonia is characterised by its numerous drumlins. In this connection, special mention should be made of the *Vooremaa* area, which is one of the most typical drumlin landscapes in the world.

The characteristic appearance of the **Vooremaa Area** (V_3) is determined by the elongated Great Drumlins, which stretch from north-west to south-east and which attain a relative height of 50 metres and more. They have an argillaceous moraine cover, and the greater part of the surface is cultivated (Fig. 18). The interstitial troughs contain lakes, swamps and shrubby meadows. A few patches of woodland clinging to the flanks of the hills are all that remains of the one-time extensive forests. Both the network of communications and the settlement of the countryside have been determined mainly by the salient elements of the surface relief. The long, straggling villages are usually situated at the foot of the slopes. The only large-scale urban settlement in the Vooremaa district is the town of Jõgeva.

The **Türi Drumlin Area** (V_4), which lies to the south-west of the Pandivere Uplands, is similar in all essential respects to the *Vooremaa* country, but on a reduced scale. The drumlins themselves, which here lie NNE-SSW, are smaller and lower.²⁹ There are no lakes, and this perhaps constitutes the principal difference between the two regions. In the distribution of the rural population and the type of settlements they are strikingly similar. The oldest urban settlement — the town of Paide — is situated on the boundary between the Pandivere Uplands and the Türi Drumlin Area. The town of Türi, which is of more recent origin, came into being at the end of the last and beginning of the present century as a railway junction and manufacturing centre on the southern fringe of the drumlin country.

²⁹ H. Barkla: The drumlins of Türi (Estonia). *Loodusuurijate Seltsi Aruanded*, Vol. XLII (Tartu, 1936), pp. 177—185.

South Estonia

South Estonia comprises that part of the Estonian uplands of which the bedrock consists of Devonian sandstone. As this is more subject to erosion than the more resistant calcareous rocks, the differences in height are greater and the surface relief more varied than in the area of the Estonian Watershed. This difference is enhanced by the fact that South Estonia is situated in the accumulation area of the continental ice, and the thickness of the moraine cover is here much greater (usually 2—6 metres, on the high ground even 100 metres and more) than in the areas lying farther to the north. The tills distributed through South Estonia are of reddish colouring and are comparatively poor in carbonate materials, and the region as a whole is characterised by carbonate-free soils on light arenaceous clays.³⁰ This in its turn has exercised a decisive influence on the formation of the vegetation cover. In other respects, however, South Estonia exhibits a number of features in common with the area of the watershed, such as the abundance of arable lands, the comparatively small number of fens and bogs, etc. These are of prime importance from the point of view of both the utilisation of the land and the distribution of the population.

The **Sakala Uplands** (VI₁), which rise in the western part of South Estonia, constitute one of the most clearly defined physico-geographical regions in the country. It is bordered by the Pärnu Lowlands, the Navesti Vale, the Basin of Lake Võrtsjärv and the Väike-Emajõgi Vale. To the south the high ground continues across the Latvian frontier. The surface relief is made up for the most part of undulating moraine plains intersected by deep primeval valleys (Fig. 19), which dissect it into a number of small plateaus.³¹ Moraine ridges and hills are to be met with only in the central part of the uplands. The highest point of the area, Rutumägi Hill, does not exceed 146 metres. The uplands are fringed by a zone of small drumlins (Fig. 20) running mostly from north to south. The south boundary, on the Latvian frontier, is characterised by sandy pine heaths.

The Sakala Uplands are fairly densely populated. For centuries they have formed one of the most prosperous districts in Estonia and they still retain their prominent position in agriculture. Settle-

³⁰ O. Hallik: Lõuna-Eesti põllumuldade lubjasus ja kohalike magevee-lubisetete tähtsus selle reguleerimisel. Резюме: Обеспеченность полевых почв южной Эстонии известью и значение местных пресноводных известковых отложений при её регулировании (Tartu, 1948).

³¹ Э. Лыокене: Геоморфология северной части Сакалаской возвышенности. Zusammenfassung: Geomorphologie des nördischen Teils des Höhengebiets von Sakala. *Tartu Riikliku Ülikooli Toimetised*, fasc. 75 (Tartu, 1959), pp. 119—154.

ments of an urban type are plentiful. The oldest and largest populated centre is Viljandi, which in Estonian conditions may be regarded as a typical middle-sized urban settlement. The towns of Suure-Jaani, Mustla, Tõrva and Kilingi-Nõmme and the boroughs of Abja-Paluoja and Nuia are local centres of insignificant industrial development. Manufacturing activities are more prominent at Mõisaküla, a town which has sprung up around a railway junction.

In so far as their natural conditions are concerned the Sakala Uplands possess, broadly speaking, much in common with the **Plain of South-East Estonia** (VI₂), which stretches from the depression of Lake Võrtsjärv to the basin of Lake Peipsi, and from the *Vooremaa* Area to the Vale of Võru and the *Palumaa* Area. The plateau itself is a fertile moraine plain (Fig. 21), intersected by deep primeval valleys. The central position among the latter is occupied by the primeval valley of the Emajõgi, which serves as a link between the Võrtsjärv and Peipsi depressions. Outcrops of red Devonian sandstone occur at many points along the valleys, striking examples being found at certain points on the banks of the Ahja (Fig. 22) and Võhandu rivers, and elsewhere. Here, too, we find stretches of undulating countryside dotted with flat, small drumlins, as for example on the shore of Lake Võrtsjärv. In certain localities groups of low glacial mounds of the *kames*-type can be distinguished beneath the forest cover that has, in most cases, sprung up on their sandy surface.³² Nevertheless, the greater part of the plain is under cultivation and densely populated. The principal centre is Tartu, the second largest town in Estonia, which is situated on the banks of the R. Emajõgi. Small urban-type settlements are represented by the town of Elva and the borough of Põlva.

In other respects the natural features of the South Estonian hills differ sharply from those obtaining on the plain. This is illustrated by the hills round Otepää, the second highest area in Estonia (Kuuste Hill 217 metres). The **Otepää Heights** (VI₃), with their rounded summits, present a surface relief of great variety. In the central part of the uplands the height of the moraine hills attains, and occasionally exceeds, 50 metres. On the outskirts of the region the hills are smaller, but the relief is no less diverse.³³ The extreme variety of the land-forms is enhanced by the unusually broken and

³² E. Markus: Kameslandschaften Estlands. *Zeitschrift der Deutschen Geologischen Gesellschaft*, Vol. 82 (1930), fasc. 1, pp. 53—59. — *Idem*: Naturkomplexe der Kameslandschaften, *ibid.*, fasc. 7, pp. 426—431.

³³ E. Hang and V. Lepaserr: Haanja ja Otepää kõrgustiku geomorfoloogias. Резюме: О геоморфологии Хааньяской и Отепяской возвышенностей. Zusammenfassung: Zur Geomorphologie der Höhegebiet von Haanja und Otepää. *Eesti NSV Teaduste Akadeemia Geoloogia Instituudi Uurimused*, Vol. VII (Tallinn, 1961), pp. 69—76.

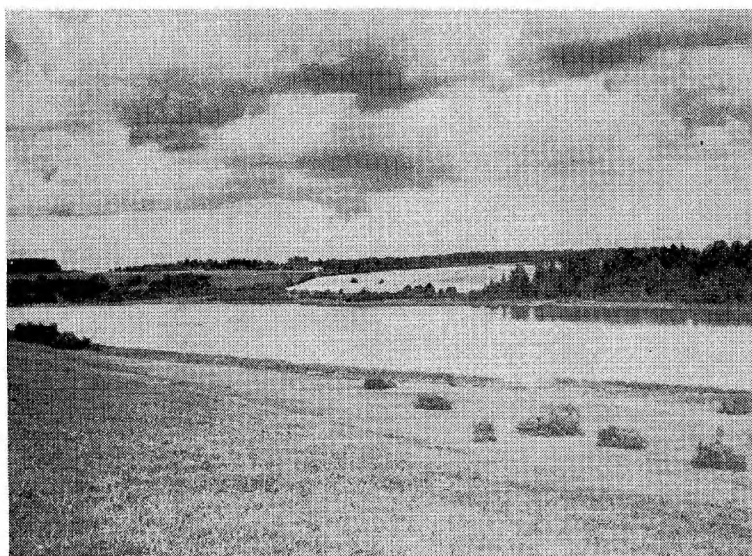


Fig. 19. Lake Viljandi in the Sakala Uplands.

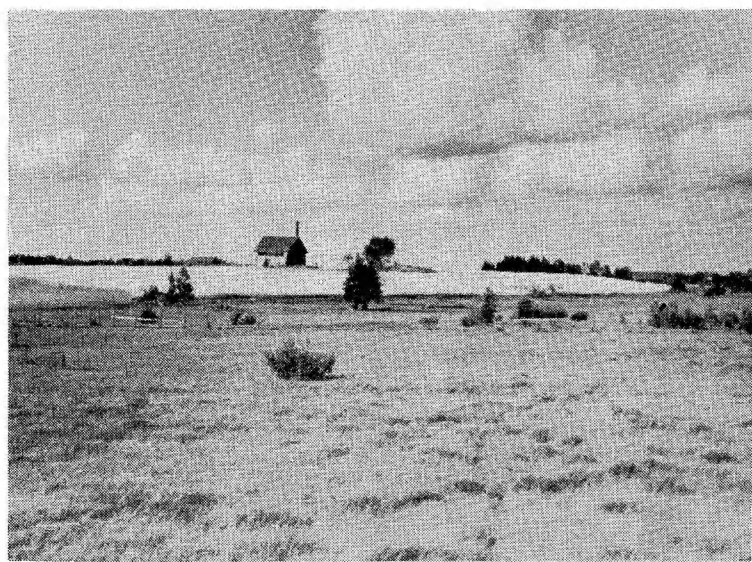


Fig. 20. Small drumlin on the south-western fringe of the Sakala Uplands.



Fig. 21. Undulating moraine landscape at Rannu on the Plain of South-East Estonia.

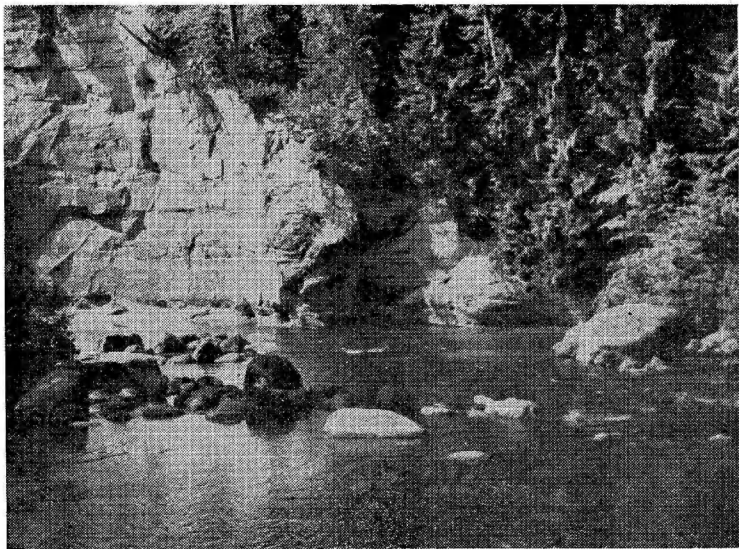


Fig. 22. Outcrop of sandstone bedrock at Taevaskoda on the banks of the R. Ahja.

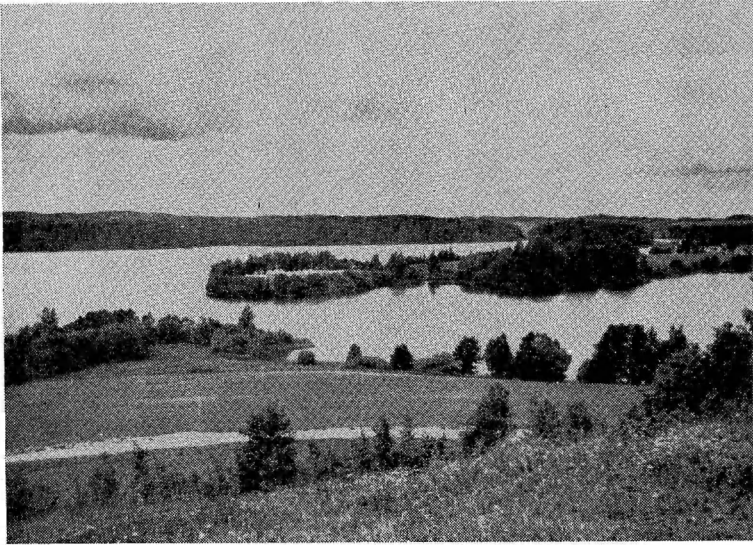


Fig. 23. Lake Pühajärv in the Otepää hills.



Fig. 24. Moraine hills in the Haanja Heights.

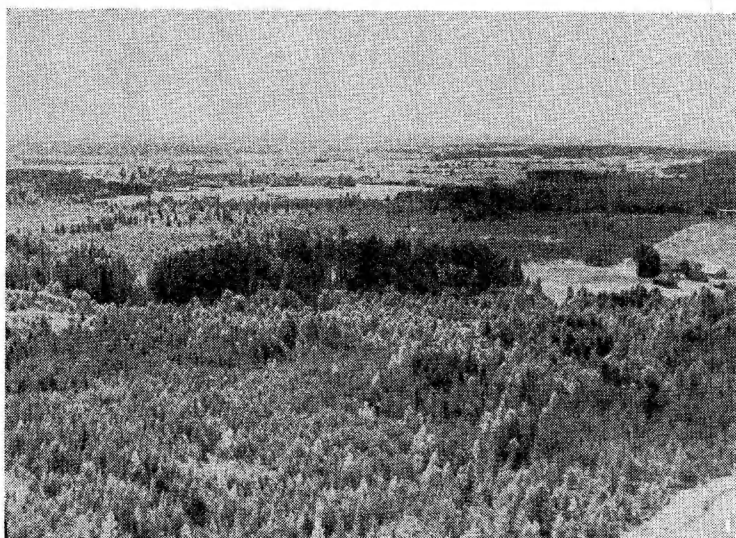


Fig. 25. The Hargla Basin in South Estonia.



Fig. 26. Sandy heath near Värskä in the *Palumaa* Area.

chequered character of the glacial deposits and the distribution of the soils. On account of the steep gradients the soils on the flanks of the hills have been to a large extent eroded, and as a result these surfaces are far less fertile.³⁴ As a general rule the steepest parts of the hillsides are forested, and the problem of their agricultural utilisation is attended by serious difficulties calling for the application of special agrotechnical devices. On the other hand, the intermediate hollows are occupied by numerous lakes (Fig. 23) and swamps, most of which are relatively small in extent. As a result the cultivable land is parcelled out and dispersed in small units, and the mechanisation of agricultural labour is rendered extremely difficult. It is only on the skirts of the uplands that we encounter here and there stretches of comparatively level ground, the surface of which, however, is deeply furrowed by primeval valleys. Landscapes of the *sandur*-type, with their sandy surfaces mostly overgrown by trees, occur to a slightly lesser extent.

The rural settlements of the region are extremely diffuse, and small hamlets and scattered farmsteads were until quite recent times the general rule. The main arteries of communication avoid the broken hilly country, with the result that there are no large settlements of an urban type. The town of Otepää, however, constitutes a small local centre which has developed into a popular tourist resort. The exceptionally favourable conditions for winter sports in the environs have attracted constantly growing numbers of enthusiasts over recent years.

To the south of Otepää the **Karula Hills** (VI₄) represent an accumulation area of the retreating ice-sheet which has resulted in a typical moraine landscape of rounded hills interspersed with large numbers of small lakes. To the south of the zone of hills stretches a sandy plain of the *sandur* type covered with extensive woodlands, broken here and there by associations of moraine and *kames*-type mounds and numerous lakes.

The **Haanja Heights** (VI₅) are the highest in Estonia and, for that matter, in all the Baltic countries, although the highest local peak, the hill of Suur Munamägi, does not exceed 317 metres. The landscapes are of the same type as those which we find in the neighbourhood of Otepää, but are still more sharply defined. The higher parts of the region are characterised by an extremely varied and picturesque setting of rounded moraine hills (Fig. 24), dotted with innumerable tiny lakes, small swamps and clumps of woodland. This type of landscape can be distinguished in four or five areas in the district as a whole. The outlying sectors, e. g. at Rõuge, are more level and even in character, being made up for the most

³⁴ R. Kask: Muldade erosioonist Eesti NSV-s. Резюме: Об эрозии почв в Эстонской ССР. Zusammenfassung: Die Erosion des Bodens in Estland. *Eesti Geograafia Seltsi Aastaraamat 1957* (Tallinn, 1957), pp. 115—135.

part of loamy moraine flats intersected by deep primeval valleys. The moraine surface cover is here thinner than in the hilly area, and outcrops of the sandstone and calcareous ground rock occur at many points along the slopes of the valleys. The stretches of arable land are both broader and less dispersed than in the moraine hills, and the villages are somewhat larger. Lastly the Haanja Heights possess fairly extensive landscapes of the *sandur* type, mainly distributed between groups of hills and along the south-eastern fringe of the uplands. These areas are rich in lakes, and for the most part they are covered with forest and sparsely populated.

The highlands of South Estonia are separated by valleys and basins of various types. These include the **Väike-Emajõgi Vale** and the **Valga Basin** (VI₆), which lies between the Sakala Uplands, the Otepää Heights and the Karula Hills. The Väike-Emajõgi Vale is characterised by *sandur* landscapes,³⁵ and consequently overgrown to a large extent with coniferous forest. Typical *sandur* areas are also to be found in the Valga Basin, but here they alternate with fertile moraine flats, partly covered with small drumlins, a result of glacial action, and elsewhere intersected by valleys. The central and lowest part of the basin is taken up by the water-meadows of Korva, which are flooded over in the spring by the middle reaches of the R. Väike-Emajõgi. Lying as it does between the above-mentioned uplands, the Valga depression forms an important point of juncture of the means of communication, while the town of Valga itself is the chief railway junction on the southern frontier of the Estonian republic. The town of Antsla stands on the eastern slope of the Basin, dominating the transitional zone linking it with the Plain of South-Eastern Estonia.

The **Hargla Basin** (VI₇) runs from the Karula Hills and the Haanja Heights to the Estonian frontier, and continues to the south, in Latvian territory, along the middle reaches of the R. Koiva (Latvian *Gauja*). This district is also largely characterised by *sandur*-type landscapes (Fig. 25), and is extensively forested. Nevertheless, patches of fertile moraine surfaces are to be found here and there, with the result that these forested areas alternate with densely populated cultivated landscapes. However, the region as a whole has no large settlements of an urban type.

The Vale of Võru in the foothills of the Haanja Heights may be regarded as an extension of the Hargla Basin. The chief urban centre here is the town of Võru, which is situated at the narrowest point of the Vale.

Farther to the east the Vale merges with the **Palumaa Area** (VI₈), of which the name indicates the presence of dry pine-woods

³⁵ К. К а я к: Геология долины реки Вяйке-Эмайги. Zusammenfassung: Die Geologie des Väike-Emajõgi-Tales. *Tartu Riikliku Ülikooli Toimetised*, fasc. 75 (Tartu, 1959), pp. 155—184.

(Est. *palu*). The area is traversed along the northern fringe of the Haanja uplands by a deep primeval valley which crosses the frontier into Russian territory. More or less dense tracts of woodland, mostly on sandy surfaces (Fig. 26), form the predominating landscape element and supply a congenial habitat to a flora rich in Pontic species.³⁶ Fertile, cultivated loamy soils are rare and as a general rule the district is sparsely populated.

*

To sum up what has already been stated, we may draw the broad conclusion that the landscapes of Estonia are extremely varied. The types represented differ sharply in both genesis and morphology, and their distribution over the territory of Estonia is highly irregular. The picture becomes still more complicated when we take into consideration the innumerable minor natural units of which each landscape is composed. Yet it is precisely these details which determine the relative importance of each locality and the productivity of the land, and which play a decisive part in establishing the broad lines of demarcation.

From this point of view landscape research is of great practical value for the study of the land resources, and it should be continued in two main directions. In the first place it is necessary to carry out still more accurate local investigations, involving detailed mapping in every sector of Estonian territory, and according individual treatment to each of the basic landscape types. Secondly the problems of generalisation and the broad scheme for the regional division of the territory not only require further elaboration, but should be linked up with the corresponding lines of research that have been initiated in the neighbouring Soviet republics of Latvia and Russia.

EESTI NSV MAASTIKULINE LIIGESTUS

E. Varep

Resümee

Eesti NSV territooriumil leidub mitmesuguseid, oma struktuurilt ja tekkelt väga erinevaid maastikke. Nende levikus võib siiski täheldada teatud üldisi seaduspärasusi, mis tulenevad eelkõige ala paleogeograafilisest arengust. Seetõttu tuleb autori arvates vabariigi füüsilis-geograafilisel (maastikulisel) rajoneerimisel lähtuda

³⁶ J. Eilart: Pontiline ja pontosarmaatiline element Eesti flooras. Резюме: Понтический и понтосарматический элемент во флоре Эстонии. Zusammenfassung: Das pontische und pontosarmatische Element in der Flora Estlands (Tartu, 1963), pp. 131—139.

geneetilisest printsiibist, mida on vaja pidada silmas nii maastiku-
tüüpide kui ka mitmesuguste regionaalsete ühikute eraldamisel.

Autor esitab artiklis Eesti NSV maastikulise rajoneerimise
skeemi, milles Madal-Eesti on jagatud neljaks, Kõrg-Eesti aga
kaheks maastikuliseks piirkonnaks. Need (Põhja-Eesti, Lääne-
Eesti, Võrtsjärve nõgu, Peipsi nõgu, Lahkme-Eesti ja Lõuna-Eesti)
jagunevad omakorda füüsilis-geograafilisteks (maastikulisteks) ra-
joonideks, mille struktuuri ja arengut on artiklis lühidalt iseloo-
mustatud.

ЛАНДШАФТНОЕ РАЙОНИРОВАНИЕ ЭСТОНСКОЙ ССР

Э. Варен

Резюме

На территории Эстонской ССР много разных по своей струк-
туре и генезису ландшафтов. В их размещении все же можно
наблюдать некоторые общие закономерности, обусловленные
прежде всего палеогеографическим развитием территории. По-
этому, по мнению автора, при физико-географическом (ланд-
шафтном) районировании необходимо исходить из генетиче-
ского принципа, который нужно соблюдать при выделении как
типов ландшафтов, так и различных региональных единиц.

В статье автор приводит схему ландшафтного районирова-
ния Эстонской ССР, в которой Низменная Эстония разделена
на четыре, а Возвышенная Эстония — на два ландшафтных
округа. Они (округи Северной Эстонии, Западной Эстонии, ни-
зины озера Выртъярв, низины Чудского озера, Водораз-
дела Эстонии и Южной Эстонии) в свою очередь подразделя-
ются на физико-географические (ландшафтные) районы, струк-
тура и генезис которых в статье коротко охарактеризованы.

ON THE RELATIONS BETWEEN ESTONIAN VALLEY TERRACES AND LAKE AND SEA LEVELS IN THE LATE-GLACIAL AND HOLOCENE PERIODS

E. Hang, T. Liblik and E. Linkrus

In the scientific study of the geomorphology and general trends of development of the Estonian valleys little attention has been paid to valley terraces. This has led to the opinion (which prevailed until recently) that Estonian valleys have only few and weakly developed terraces. The origin of such an opinion was undoubtedly due to the fact that there were extremely few concrete investigation data on the occurrence of terraces in Estonian valleys. The only attempt to study the terraces of some North-Estonian valleys more systematically was made by A. Tammekann who, moreover, tried to relate them to the water-levels in the Baltic Sea basin during the Late-glacial and Holocene periods.¹ A. Tammekann has also thrown some light upon the general conditions which gave rise to the formation of valley terraces. He has done this in his short survey of the development of the North-Estonian Glint in the Late- and Post-glacial periods.² The paper was presented at the International Geographical Congress in Warsaw (in 1934). Another paper, which dealt with the Baltic Glint, also referred to this subject.³

In recent years, thanks to the research work conducted by our geologists and geographers, we have been able to obtain more detailed data on our valley terraces. In this connection it has become clear that terraces are rather characteristic of Estonian valleys and deserve more attention in the solution of various geo-

¹ A. Tammekann: Die Oberflächengestaltung des nordostestländischen Küstentafellandes. *Publicationes Instituti Universitatis Dorpatensis Geographici*, fasc. 12—14 (Tartu, 1926).

² A. Tammekann: Die Entwicklung der nordestländischen Kliffküste während der spät- und postglazialen Zeit. *C. R. du Congrès International de Géographie, Varsovie 1934*, tome deuxième, travaux de la section II (Varsovie, 1936).

³ A. Tammekann: The Baltic Glint. *Publicationes Instituti Universitatis Tartuensis Geographici*, fasc. 24 (Tartu, 1940).

morphological⁴ and palaeogeographical⁵ problems. The more so, as in the areas that are closely connected with the investigation of the valley terraces, especially the investigation of periglacial lakes, the development of the Baltic Sea and the study of neo-tectonic movements, appreciable advances have been made in the Estonian S. S. R., although the results are not exhaustive as yet. In the investigation of valley terraces it is possible, on the one hand, to make use of the data already published and, on the other hand, those data may be supplemented and defined more precisely.

*

According to all the data available Estonian valley terraces have developed in the Late-glacial and Holocene periods when there were favourable conditions for this formation. During this geological period, on the retreat of the inland ice and the successive spread of periglacial lakes and other sea-like waters (local meta-chronical ice-dam lakes of various base-levels, the Baltic periglacial lake, the Yoldian sea, the Ancylus lake, the Littorina sea, the Limnaea sea) there has taken place a variation in the water-level of the above-mentioned bodies of water under the influence of eustatic and neo-tectonic agents, with a general tendency towards the fall in the water-level, i.e. the erosion basis (Fig. 1). The intensity of the neo-tectonic movements — a gradual uplift of the earth's crust — has at the same time been, and is also at present greater in the north-western part of Estonia, whereas it decreases towards the south-east.⁶ Accordingly, there has been a gradual expansion of the mainland and the development of the valleys has

⁴ S. K ü n n a p u u: Pirita jõe alamjooksu oru genees. Summary: The Genesis of Pirita Valley in the Lower Course of the River. *Eesti Geograafia Seltsi Aastaraamat* 1957 (Tallinn, 1957). — I. A r o l d: Jägala ümbruse geomorfoloogias. Zusammenfassung: Zur Geomorphologie der Umgebung von Jägala. *Eesti Geograafia Seltsi Aastaraamat* 1959 (Tallinn, 1960). — E. Linkrus: Valgejõe alamjooksu oru geomorfoloogias. Summary: On the Geomorphology of the Lower part of the Valgejõgi Valley. *Eesti Geograafia Seltsi Aastaraamat* 1962 (Tallinn, 1963).

⁵ К. К а я к: Геология долины реки Вяйке-Эмайыги. *Ученые записки Тартуского государственного университета*, вып. 75 (Тарту, 1959). — E. L õ o k e n e: Sakala kõrgustiku orgude geoloogias. Summary: The Geology of the Valleys of the Sakala Hill District. *Eesti Loodus*, Vol. III, No. 2, 1960. — A. M i i d e l: Holotseenise orgude geoloogilise arenemise seaduspärasusi Põhja-Eestis. Summary: General Trends in the Geological Evolution of Holocene Valleys in North Estonia. *Eesti NSV Teaduste Akadeemia Geoloogia Instituudi Uurimused*, Vol. VII (Tallinn, 1961).

⁶ G. Z e l n i n: Maakoore kerkimine Eestis. Summary: Rise of the Earth's Crust in Estonia. *Eesti Loodus*, Vol. I, No. 5, 1958. — Г. Желнин: Изучение вертикальных движений земной коры в Эстонской ССР методом повторных нивелировок. *Материалы совещания по вопросам неотектонических движений в Прибалтике* (Тарту, 1960).

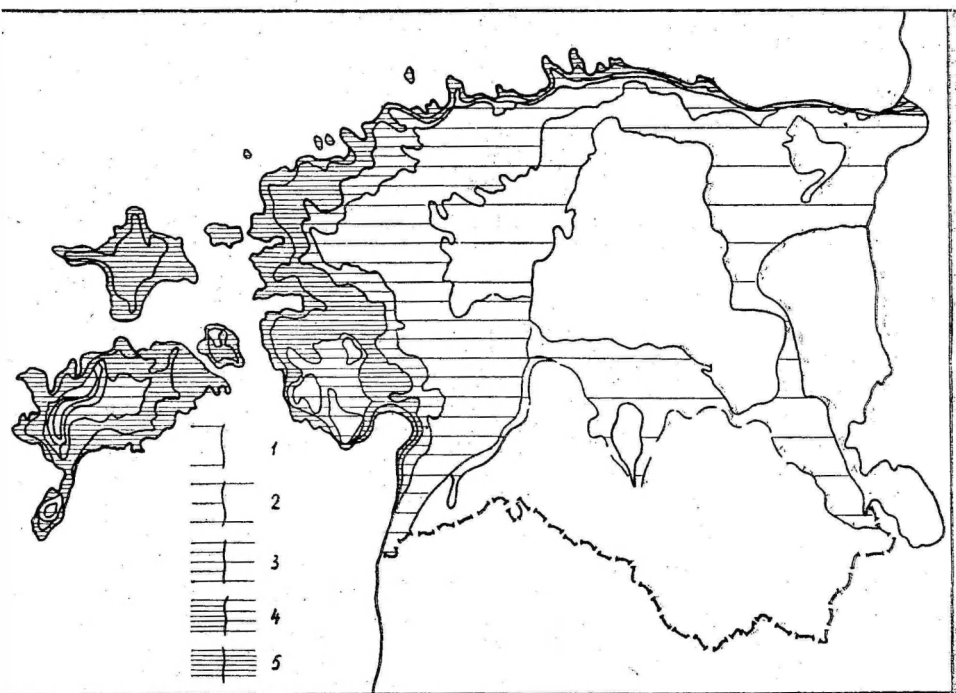


Fig. 1. The spread of the ancient shore-lines in Estonia (after K. Orviku).
 1 — The maximum extent of the local metachronal ice-dam lakes; 2 — The maximum extent of the Baltic periglacial lake; 3 — Maximum extent of the Ancylus Lake; 4 — Maximum extent of the Littorina Sea; 5 — Maximum extent of the Limnaea Sea.

been rather peculiar — the valleys become elongated towards the lower reaches of the rivers.

Inasmuch as the formation of valley terraces is connected with the fluctuation of the water-level of the above-mentioned waters as the basis of erosion, then in the process of ascertaining the course of development of valley terraces one of the main problems is the correlation of the terraces with the above-mentioned water-levels.

It is naturally easier to ascertain the correlation if we have more precise information about the ancient shorelines and water-levels, and if the data on the extent and altitudinal relations of the valley terraces are more detailed. The old shore-lines and water-levels of the Late-glacial and Holocene lake- and sea-basins (especially those of the Baltic Sea) in the area of the Estonian S. S. R. are now generally known, thanks to the research work of a number of scientists. A great deal of new information has been

obtained from the recent investigations. The results of this work have been summarized by K. Pärna and H. Kessel.⁷

In ascertaining the extent and altitudinal relations of the valley terraces in the Estonian S.S.R., where the differences in the heights of the terraces are slight, in general, a very effective methodical device has proved to be the compiling of a detailed spectrum of the terraces by means of geometric levelling. This device has also been used by the authors (Fig. 3 and 4). Such a spectrum of terraces enables one at the same time to correlate geomorphologically the valley terraces with the ancient shore-lines and water-levels. The starting point is usually as follows: the terrace represents a one-time valley bottom. The height of the terrace in its lower parts where the declivity of the terrace is slightly longitudinal or horizontal, shows approximately the height of the water-level which has been the basis of erosion during the formation of the surface of the terrace (the valley bottom). The particular site where one terrace or the other ends in the lower part of the valley, shows the site of the river-mouth (the shore-line of a lake or a sea) during the formation of the surface of the terrace.

The first person to make use of this correlation method in Estonia was A. Tammekann who employed it in investigating the valleys of North Estonia.⁸ But as the old water-levels of the Baltic Sea had been investigated to a remarkably lesser degree in comparison with the present-day investigations, he could not point out in detail the connection between the former and the valley terraces.

*

On the basis of various lines of development and the present geomorphological character, which at the same time reflect the main peculiarities of the Estonian relief, the old pre-anthropogenic topography included, the Estonian valleys fall into three regional groups — the valleys of North, West and South Estonia.⁹ The available data on the valley terraces tend to support this division, it being possible nowadays to point out some distinguishing

⁷ К. Пярна: О геологии Балтийского приледникового озера и больших местных приледниковых озер на территории Эстонии. *Труды Института геологии Академии Наук ЭССР*; том V (Таллин, 1960). — Х. Кессл: О геологии голоценовых береговых образований Балтийского моря на территории Эстонской ССР. *Труды Института геологии Академии Наук ЭССР*, том V (Таллин, 1960). — *Idem*: Древние береговые образования бассейна Балтийского моря в Эстонской ССР. *Труды Института геологии Академии Наук ЭССР*, том VIII (Таллин, 1961).

⁸ А. Таммеканн, *op. cit.* [see footnote 1 above].

⁹ К. Орвику: Eesti geoloogilisest arengust antropogeenis. *Eesti Loodus*, Vol. III, No. 1 and 3, 1960. — К. Орвику: О неотектонических движениях в Эстонской ССР на основе геологических данных. *Материалы совещания по вопросам неотектонических движений в Прибалтике* (Тарту, 1960).

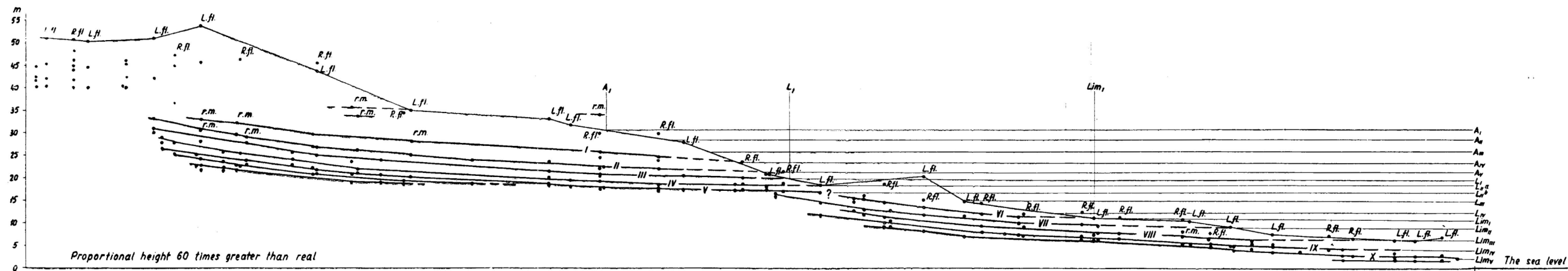


Fig. 3. The terraces of the lower part of the Valgejõgi Valley. L. f. — left flank; R. f. — right flank; r. m. — residual mounds.

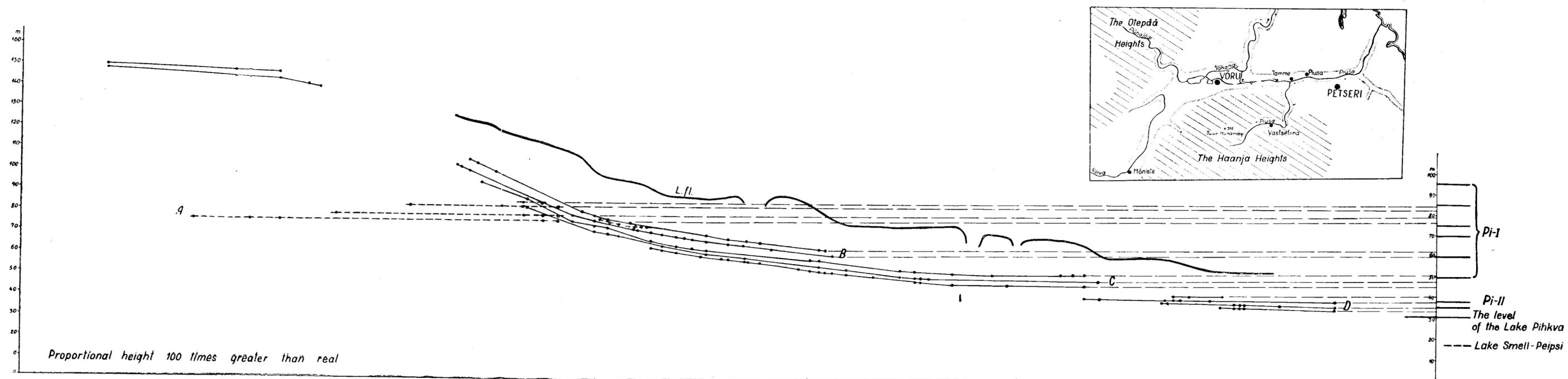


Fig. 4. The terraces of the Piusa Valley. The broken line marks the terraces in the Võru-Petseri Valley in the area between Võru and Tamme.

Table I

The terraces of the Valgejõgi Valley and their relation to the phases of development of the Baltic Sea

Terraces	Average height of terrace above river-level (metres)	Absolute height in lower reaches (metres)	Absolute heights of water-levels corresponding to phases of Baltic Sea		Relation of terraces to phases of Baltic Sea
			Phase of development	Altitude in metres	
A. In the area between Nõmmeveski and Kotka			A _I	30.0—30.5	
			A _{II}	28.0—28.5	
			A _{III}	24.5—25.5	
Terrace I	10.0—11.0	24.5—23.5	A _{IV}	22.7—23.0	Valley bottom during phase A _{IV}
Terrace II	7.0	21.5—21.0	A _V	21.0	Valley bottom during phase A _V
Terrace III	5.5—6.0	20.0—19.5	L _I	19.0—19.3	Valley bottom during phase L _I
Terrace IV	3.5—4.0	18.5—18.0	L _{IIa}	17.5—18.5	Valley bottom during phase L _{IIa}
Terrace V	2.0—2.5	16.5	L _{IIb}	16.5	Valley bottom during phase L _{IIb}
Lower terraces below the Nõmmeveski area	2.5—3.0 2.0	Approaches the level of terrace V	L _{III} L _{IV}	14.0—14.5 11.5—12.0	
B. The area between Kotka and the river mouth					
Terrace VI	6.5	11.0—10.5	Lim _I	10.2—10.5	Valley bottom during phase Lim _I
Terrace VII	5.0	9.0—8.5	Lim _{II}	8.1—8.5	Valley bottom during phase Lim _{II}
Terrace VIII	3.0—3.5	6.5—6.0	Lim _{III}	5.5—6.5	Valley bottom during phase Lim _{III}
Terrace IX	2.5	4.0—3.7	Lim _{IV}	3.5—4.0	Valley bottom during phase Lim _{IV}
Terrace X	2.0	2.0	Lim _V	1.8—2.0	Valley bottom during phase Lim _V

features of the course of development of the existing terraces, though data on the terraces of the West-Estonian valleys are lacking as yet. This viewpoint will be corroborated in the following, where two valleys, the valley of the lower course of the Valgejõgi and the Piusa valley have been taken as examples. The former of these valleys represents a typical North-Estonian, the later a typical South-Estonian valley. These valleys were investigated by the authors in the years 1959, 1960 and 1963. As to the methodological aspect, the investigation of the valley of the Valgejõgi, which flows into the Gulf of Finland, where there are plenty of terraces and the height of the old water-levels of the Baltic Sea around the lower course of the valley is known in detail, was of considerable importance in estimating the application of the above-described correlation method. When investigating the valley of the Piusa river which flows into Lake Pihkva (Pskov), where we had at our disposal relatively inaccurate data on the old water-levels of Lakes Pihkva and Peipsi, it was interesting to ascertain to what extent the valley terraces can confirm the heights of water-levels in this basin which have been pointed out up to now.

*

The valleys of the North-Estonian rivers that flow into the Gulf of Finland are in their upper and middle reaches (situated on the North-Estonian limestone plateau) low for the most part and gently sloping in their longitudinal profile.

On dropping from the plateau the rivers have eroded their valleys into the steep northern bank of the plateau — the Glint, following at the same time the ancient broad valleys, the so-called "Glint bays". These rivers have produced falls in the canyon-like sections of the valleys that have formed below the Glint. Within the boundaries of the accumulative coastal lowland in front of the Glint the fall of the valleys becomes small again, with the exception of some rapids. The latter may be found in places where the river bed penetrates the moraine rich in erratic boulders.

An essential prerequisite for the formation of terraces in the North-Estonian valleys has been the neo-tectonic land uplift, the intensity of which has been greater in the lower course of the valley and has decreased towards the upper courses.

The rapid fall in the sea-level alternately with its numerous interruptions and transgressive phases of development has caused a quick changing of erosion cycles and an abundance of terraces in these valleys, the differences in the heights of the terraces being very slight.

The valley of the lower course of the Valgejõgi (Fig. 2) is situated in the western part of the Glint bay of the Valgejõgi-

Loobu (described by A. Tammekann).¹⁰ The Glint here is traceable as a terrace of about 12—13 metres, running from the north-west to the south-east, situated to the west of the valley. In the immediate vicinity of the Valgejõgi the Glint is buried under fluvio-glacial sand and gravel. Here the Glint is marked by a fall seventeen kilometres upstream from the river mouth, in the Nõmmeveski canyon. On the walls of the canyon, which are about twenty metres high, Ordovician sandstone, slates and limestone are exposed.

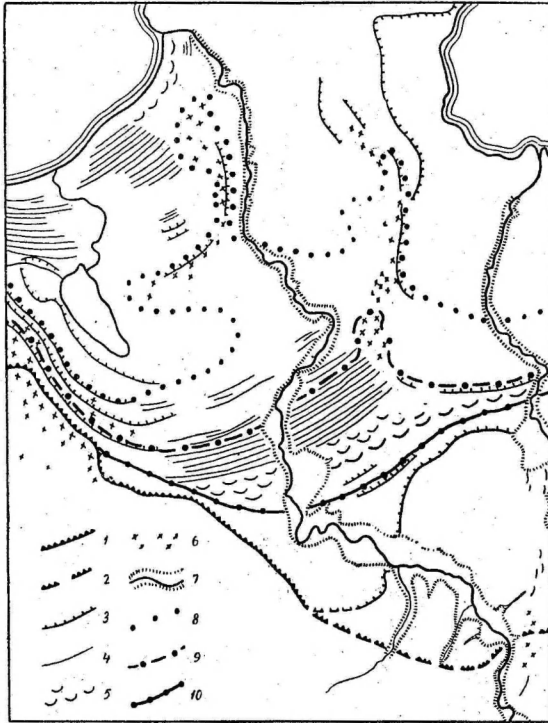


Fig. 2. Geomorphological scheme of the lower reaches of the R. Valgejõgi.

- 1 — The escarpment of the Glint;
- 2 — The Glint edge buried under glacial deposits;
- 3 — Abrasion cliffs;
- 4 — Coastal barriers;
- 5 — Dune chains and raised beaches, partly developed into dunes;
- 6 — Erratic boulders;
- 7 — The river valley;
- 8 — Maximum extent of the Limnaea Sea;
- 9 — Maximum extent of the Littorina Sea;
- 10 — Maximum extent of the Ancylus Lake.

In the present paper a section of the valley which is situated downstream from the Nõmmeveski fall has been examined. The total fall of the river in this sector of the valley is 37.2 metres, the average fall 2.15 metres per km. Seventeen metres of the general fall belong to the Nõmmeveski falls and to the rapids at its foot, whereas 8.7 metres belong to the Kotka rapids, further on from here.

Various questions concerning the geomorphology of the valley in the lower reaches of the Valgejõgi and the areas in its neigh-

¹⁰ A. Tammekann, *op. cit.* [see footnote 3 above].

bourhood have been dealt with in a number of papers published earlier.¹¹ The uplift of this area from under the sea began towards the end of the Baltic periglacial lake stage. The recession of the shore-line and its former positions are marked by numerous old coastal barriers and terraces, erratic boulders, abrasion-accumulation plains forming sea terraces and other shore formations (Fig. 2). Their levelling has made it possible to define more accurately the height of the water-levels during separate phases of development of the Baltic Sea which had been pointed out by P. Kents and H. Kessel¹² (Table I).

There are plenty of terraces in the valley of the lower course of the Valgejõgi but they have a relatively small altitude and occur intermittently (as segments). They divide into two "bunches" of terraces. Moreover, the bottom of the valley, which nowadays is not subjected to the accumulation processes of the river, has also been included among the terraces (Fig. 3 and Table I).

The highest of the terraces under consideration is not absolutely the oldest of the terraces in the valley of the Valgejõgi. This fact is testified by higher border elevations and solitary sectors of terraces in the upper part of the valley under consideration. But their number is too small to enable us to point out definitely separate and independent terrace-levels. In this case the investigation of the upper and middle reaches of the Valgejõgi valley must provide the final answer.

All the terraces under consideration belong to the Holocene period. In their lower reaches they correspond to some phases of development of the Baltic Sea water-level in the Holocene period, and at the same time they end near the shore-line corresponding to the latter, which is marked by the old shore formations in the neighbourhood of the valley. The part of the terrace near the mouth of the river remains usually 0.5—1 metres higher than the corresponding old water-level of the Baltic Sea, which coincides chronologically with the time of its formation. This is quite natural

¹¹ K. Orviku: Jugadest Põhja-Eesti pangal. *Eesti Loodus*, Vol. III, No. 4, 1935. — *Idem*: Vasaristi salajõgi. Summary: The subterranean river in Vasaristi. *Eesti Loodus*, Vol. IV, No. 1, 1936. — A. Valsiner: Valgejõe org: *Looduskaitse teatmik* (Tallinn, 1960). — A. Miidel: Vasaristi org. Summary: The Vasaristi Valley. *Eesti Loodus*, Vol. V, No. 4, 1962. — A. Miidel, *op. cit.* [see footnote 5 above]. — E. Linkrus, *op. cit.* [see footnote 4 above]. — А. Михайдел: Распределение падений рек Северной Эстонии. *Труды Института геологии Академии Наук ЭССР*, том XII (Таллин, 1963).

¹² P. Kents: Postglatsiaalsed Läänemere randjoone võnkumised Eestis illustreeritud Kõpu poolsaarel (Tartu, 1939). MS. in the library of Tartu University. — H. Kessel: Balti mere arenemisest Eesti NSV territooriumil holotseenis. Zusammenfassung: Über die Entwicklung der Ostsee im Bereich des Territoriums der Estnischen SSR im Holozän. *Eesti NSV Teaduste Akadeemia Geoloogia Instituudi Uurimused*, Vol. VII (Tallinn, 1961). — X. Кессел, *op. cit.* [see footnote 7 above].

and proves at the same time the validity of the pertinent assumption of A. Tammekann.¹³

As can be seen from the above-mentioned, most of the phases of the development of the Baltic Sea have left a clear imprint on the spectrum of the valley terraces. Somewhat more vague is the question concerning the last phases of the Littorina sea (L_{III} and L_{IV}). Those phases may possess, respectively, two short and low terraces in the sector of the valley at the foot of the Nõmmeveski fall, although as a rule, the appearance of short terraces is generally noted at the foot of rapids and falls, in comparison with other sectors of the valley.¹⁴

The formation of the terraces in the lower part of the valley may have been hindered by the local erosion basis in the area of the Kotka rapids, which probably began to exert its influence during the third phase of the Littorina sea. In connection with this some attention should be paid to the structure of terrace V (corresponds to phase L_{II}^b) and to the fact that the lower parts of the short terraces at the foot of the Nõmmeveski fall approach the level of terraces V. The comparatively poor state of preservation of terrace III (corresponds to phase L_I) and of terrace IV (corresponds to phase L_{II}^a) deserves also some attention. Terrace V differs remarkably from the rest. It consists almost entirely of alluvium and is extremely crenulated by bends. This harmonizes, on the one hand, with the transgressive character of phase L_{II}^b that caused the alluvial accumulation and increased the meandering of the river; on the other hand it proves the influence on the formation of the valley of the Kotka rapids as a local erosion basis. Under the influence of this local erosion basis the water-level of the river in the area around Kotka remained for a long time more or less at the same level, a circumstance which prevented the formation of terraces in the sector of the valley between the Nõmmeveski canyon and Kotka during phases L_{III} , L_{IV} and later on. A marked destruction of terrace III took place at the time of the formation of terrace IV and the latter was subjected to destruction at the time of the formation of terrace V, when an intensive lateral erosion occurred due to the transgressive character of phases L_{II}^a and L_{II}^b respectively.

An important factor in the formation of terraces in the valley of the Valgejõgi, and in the North-Estonian valleys in general, has been the inclination (declivity) of the earth's surface which rose from the sea. The greater the incline, the more intensive the accompanying bottom erosion, and the closer is the actual spectrum

¹³ A. Т а м м е к а н н, *op. cit.* [see footnote 1 above].

¹⁴ Е. Н. Былинский: Общие схемы развития продольного профиля реки на порогах и водопадах в полярных областях. *Вопросы физической географии полярных стран*, вып. 2, МГУ (Москва, 1959).

of the terraces to the theoretical one, so characteristic of elevation areas, spreading fanwise towards the mouth of the river.¹⁵

It seems most likely that the comparatively small incline of the earth's surface that has risen out of the sea, together with the local erosion bases, is another reason for the absence of the typical spectrum, spreading fanwise towards the river mouth, of the terraces in the lower reaches of the Valgejõgi.

*

The rivers of South Estonia take their rise from the hilly moraine uplands where the character of these valleys depends on the glacial relief of the last glaciation period.

Descending from the uplands these rivers have eroded canyons with sharp falls deep in the Devonian sandstone. In their lower course the recent valleys coincide with the old buried ones which enter the great lake basins (the basins of Pihkva-Peipsi and Võrtsjärv).

The lower regions of South Estonia were inundated by the waters of the local periglacial lakes during the Late-glacial period. The melting water of the inland ice flowed into the ice-dam lakes from the uplands, eroding new valleys or using old ones as a stream bed. The water carried into these valleys fluvio-glacial sand deposits in the form of *valley sandurs*.¹⁶ It is the surfaces of these *valley sandurs* that at present form terraces in the valleys of South Estonia. In comparison with the valleys of North Estonia the valley terraces in South Estonia are far more marked and occur more continuously.

Gradually, towards the end of the Late-glacial and at the beginning of the Holocene period, as the water-level of the periglacial lakes that had served as an erosion basis steadily fell in accordance with the recession of the edge of the ice cover or with the escape of outflows, the lower reaches of these valleys cut ever deeper into the earth and the formation of *valley sandurs* (terraces) took place at an even lower level. Consequently, the valley terraces in South Estonia were formed during the Late-glacial period as a result of the gradual fall in the water-level of the local glacial lakes. But it was already at the beginning of

¹⁵ A. Miidel, *op. cit.* [see footnote 5 above].

¹⁶ K. Pärna: Elva liivik, selle kujunemine ja kujunemisaegne hüdrograafia. Summary: The Elva Sandur, its formation and early hydrography. *Eesti Loodus*, Vol. 1, No. 3, 1958. — К. Каяк, *op. cit.* [see footnote 4 above]. — E. Haang and V. Lepasepp: Haanja ja Otepää kõrgustiku geomorfoloogiast. Zusammenfassung: Zur Geomorphologie der Höhengebiete von Haanja und Otepää. *Eesti NSV Teaduste Akadeemia Geoloogia Instituudi Uurimused*, Vol. VII (Tallinn, 1961). — К. Каяк: О краевых ледниковых образованиях Юго-Восточной Эстонии. *Труды Комиссии по изучению четвертичного периода*, том XXI (Москва, 1963).

the Holocene period that the process of formation of the lower parts of these valleys changed: the deepening of the valleys was replaced by the accumulation of alluvium. This was connected with the different intensity of the neo-tectonic land uplift in the north-western and south-eastern parts of Estonia during the Holocene. As a result of the more intensive rising of the north-western part, as compared with the south-eastern part, there occurred (and the process is still in progress) an inclination to the south of the waters of Lakes Pihkva-Peipsi and Võrtsjärv. In the southern parts of the lake basins, towards which the rivers of South Estonia flow, there took place an uplift of the erosion basis which still continues.¹⁷

As a result, there were no prerequisites for the formation of terraces in these valleys during the Holocene. Moreover, as observed by K. Kajak during his investigation of the Väike-Emajõgi valley, which takes its rise from the Otepää Heights and enters Lake Võrtsjärv,¹⁸ in the lower parts of these valleys there has occurred a partial burial of the previously formed lower terraces under alluvium and bog sediments.

The P i u s a (Fig. 4) has the greatest fall among the Estonian rivers. It takes its rise from the Haanja Heights, near the highest point in the Baltic area — Suur Munamägi (317 m above sea-level). The river starts at a height of 245 m above sea-level and flows into Lake Pihkva (30 m above sea-level). The length of the river is 102.4 km, the total fall 215 metres, the average fall 2.1 metres per km. In its lower course the recent Piusa valley follows the eastern part of the deep Võru-Petseri valley. This ancient valley connects the basin of Lake Pihkva-Peipsi with the Gauja river basin. In the valley around Võru there has taken place the formation of a considerably boggy watershed which rises about 75 metres above sea-level.

When we move along the Piusa valley towards the lower reaches, we come across terraces first of all around Vastseliina, which occupies a low depression in the hilly moraine relief. During the Late-glacial period there has appeared in the depression a small local glacial basin which was dammed by a higher chain of moraine blocking the depression in the east. Two of the terraces in this depression were formed in the process of replacing the lacustrine regime by that of the stream which sprang into being after the waters of the lake had broken through the chain of hills blocking the basin from the east. The higher of the terraces obviously represents the bed of the periglacial lake. It consists of limno-glacial sediments which contain typical varved clay. The lower terrace has come into existence under the conditions

¹⁷ К. Орвику, *op. cit.* [see footnote 9 above].

¹⁸ К. Каяк, *op. cit.* [see footnote 5 above].

of flowing water. The terraces do not continue in the direction of the lower reaches. Neither can they be related to the terraces that occur in the lower reaches.

The terraces in the remaining part of the Piusa valley and in the western part of the Võru-Petseri valley (the segments between Võru and Tamme) may be grouped into four systems of "bunches" (Fig. 4, A, B, C, D). The formation of these terraces is connected with the development of a periglacial lake which existed in the area of Lake Pihkva in the recession period of the inland ice. The development of this body of water and its water-levels during separate phases of its evolution have been in general outline elucidated by H. Hausen, W. Ramsay, and in still greater detail in the writings of E. Rähni, a scientific worker at the Institute of Geology of the Estonian Academy of Sciences. The materials gathered by E. Rähni have so far been only partially published.¹⁹ The above-mentioned authors have in their elucidation of the water-levels of the glacial lakes based themselves on the altitudes of the flat surfaces of various lateral formations fringing the ice (*kames, âsar, fluvio-glacial deltas*) which approximately mark the water-level of the periglacial lake encircling the edge of the continental ice at the time of appearance of these formations. At the same time the heights have not been levelled, but have been ascertained by means of topographical maps, a method which does not yield precise data. Therefore the heights of the water-levels pointed out by the aforementioned authors cannot be relied upon as something definite that cannot be modified or made more precise in the course of further investigation.

The present paper cannot afford to deal very exhaustively with the development of the body of water in the basin of Lake Pihkva. In this connection the fact should be mentioned that E. Rähni has pointed out interruptions in the process of the diminution of the water-level of the abovementioned body of water at 95, 85, 70, 60, 50 and 38 metres above sea-level. These data are supplemented by interruptions at 75 and 35—36 metres above sea-level as noted by H. Hausen. The water-levels that exceed the height of 50 metres above sea-level belong, according to E. Rähni, to various phases of the Pihkva periglacial lake I (abbr. Pi-I), the water-level of 38 metres belongs to Pihkva periglacial lake II (abbr. PI-II).

Taking into account a certain inaccuracy of the correlation used, especially the approximate character and probable insufficiency of the available data on the ancient water-levels in the

¹⁹ H. Hausen: Über die Entwicklung der Oberflächenformen in der russischen Ostseeländern und angrenzenden Gouvernements in der Quartärzeit. *Fennia*, Vol. 34, fasc. 3, 1913. — W. Ramsay: Niveaushiftungen, eisgestaute Seen und Rezession des Inlandeises in Estland. *Fennia*, Vol. 52, fasc. 2, 1929. — E. Rähni: Viimase mandrijää taganemisest Põhja-Eestist. Zusammenfassung: Über das Zurückweichen des letzten Inlandeises aus Nordestland. *Geoloogiline kogumik* (Tartu, 1961).

basin of Lake Pihkva, a fact that is comprehensible in view of the enormous scope and technical difficulties of such research, it cannot be expected that every terrace in the Piusa valley should be definitely correlated with some ancient water-level in the basin of Lake Pihkva. It should be noted that the general correlation is obvious enough. On the basis of the terrace spectra all the above-mentioned interruptions in the water-level can be corroborated, with the exception of the interruptions at 95 and 70 metres above sea-level. At the same time it is evident that there are more clearly traceable terraces in the Piusa valley than have been ascertained in the water-level of the body of water that existed in the basin of Lake Pihkva during the Late-glacial period. The aim of further investigations, in addition to that of defining more accurately the interruptions in the water-level, is to find out whether the assumption is well-grounded that there may have been more interruptions in the process of the diminution of the water-level. In view of the terrace spectrum of the Piusa valley this is quite feasible.

In the westerly part of the Võru-Petseri valley, between the levels of 84 and 76 metres above sea-level, i.e. higher than the watershed between the Piusa and the Gauja (Koiva), there exist terraces belonging to "bunch" A which may be regarded as confirming the viewpoint of some previous authors that at a time of higher water-levels in the Pihkva periglacial lake the water flowed westward along the Võru-Petseri valley — into the Gauja basin. The terraces with respective inclinations that directly mark this flow line must be apparently sought for west of Võru. The terraces of terrace "bunch" A can be brought into correlation with the Pihkva periglacial lake I (Pi-I), pointed out by E. Rähni.

Terraces B, C, and D of the terrace "bunch" in the Piusa valley which end in the lower reaches at levels of 62, 60, 51, 48, 45, 41, 37, 35 and 33 metres above sea-level mark the direction of the flow along the Piusa valley into the ice-dam lake. The terrace under discussion in the Võru-Petseri valley, which is at a lower level than the terraces of "bunch" A, joins the highest terrace of terrace "bunch" B. The flow in an easterly direction started after the fall of the water-level in the Pihkva periglacial lake to a level lower than 75 metres above sea-level. The formation of terraces is connected with the interruptions in the fall of the water-level from the lower levels of Pihkva periglacial lake I until the formation of Lake Väike-Peipsi (Small Peipsi), whose level was lower than the present water-level of Lake Peipsi, in the northern part of the basin. This occurred towards the end of the Late-glacial and at the beginning of the Holocene period.²⁰ The

²⁰ K. Orviku, *op. cit.* [see footnote 9 above].

basin of Lake Pihkva was then probably a dry land area. The Velikaya river that had cut its way further to the north entered Lake Väike-Peipsi; it flows now into the northern part of Lake Pihkva. The Piusa was apparently a tributary of the Velikaya. This viewpoint is also supported by J. Eilart in his investigation of plant geography.²¹ The terraces in the Piusa valley that end at 62, and 60 metres, 51 and 48 metres above sea-level are obviously correlated with the interruptions (pointed out by E. Rähni) in the water-level of Pihkva periglacial lake I at 60 and 50 metres above sea-level, respectively. The terraces that end at 41, 37 and 35 metres above sea-level might mark interruptions in the water-level of the Pihkva periglacial lake II, when the water-level remained for a long time ca. 38 metres above sea-level, or they might mark the interruption in the water-level at 35—36 metres above sea-level as observed by H. Hausen. As a result of the neotectonic land uplift, which was more intensive in the northern areas of the Estonian S.S.R., the conditions for outward flow in the direction north of Lake Väike-Peipsi became worse during the Holocene. The water-level of the lake began to rise gradually and at the same time the waters of the lake started inclining back to the south until they reached the present contours of the lake. This process was accompanied by the accumulation of alluvium and peat in the lower part of the Piusa valley where it amounts to a thickness of about 10 metres.²² It may well be possible that the terraces of "bunch" D have been partially buried under the alluvial sediments and peat that accumulated during the Holocene period.

MÄRKMEID ORUTERRASSIDE SEOSE KOHTA HILISJÄÄAJA NING HOLOTSEENI JÄRVE- JA MERETASEMETEGA EESTIS

E. Hang, T. Liblik ja E. Linkrus

Resümee

Tuginedes antropogeeni paleogeograafiat ning orgude geoloogiat käsitlevale kirjandusele, analüüsitakse artiklis oruterrasside tekkimist Eesti NSV territooriumil hilisjäääaja ja holotseeni vältel. Seejuures tõstetakse esile oruterrasside tihedat seost Läänemere ning Pihkva-Peipsi järve vanade rannajoonte ja veetasemetega,

²¹ J. Eilart: Pontiline ja pontosarmaatiline element Eesti flooras. Zusammenfassung: Das pontische und pontosarmatische Element in der Flora Estlands. (Tartu, 1963).

²² К. Орвику: Геоморфология Эстонской ССР. Геология СССР, том XXVIII (Москва, 1960).

mis on ilmnenud vastavalt Valgejõe alamjooksu oru ja Piisa oru terrasside uurimisel autorite poolt. Oruterrasside korreleerimisel vanade rannikumoodustiste ning neile vastavate veetasemetega on autorid rakendanud geomeetrilise nivelleerimise andmete põhjal koostatud oruterrasside spektrit.

К ВОПРОСУ О КОРРЕЛЯЦИИ ДОЛИННЫХ ТЕРРАС С УРОВНЯМИ ПОЗДНЕЛЕДНИКОВЫХ И ГОЛОЦЕНОВЫХ ОЗЕРНЫХ И МОРСКИХ ВОДОЕМОВ НА ТЕРРИТОРИИ ЭСТОНИИ

Т. Либлик, Э. Линкрус и Э. Ханг

Резюме

Опираясь на литературу о палеогеографии антропогена и геологии долин, авторы сделали попытку проанализировать условия формирования долинных террас в позднеледниковое и голоценовое время на территории Эстонии. При этом подчеркивается тесная связь долинных террас с древними береговыми линиями и уровнями вод Балтийского моря и Псковско-Чудского озера, установленная авторами при исследовании долины нижнего течения р. Валгейги и долины р. Пиуза. При корреляции террас этих долин с древними береговыми линиями и соответствующими им уровнями вод использован спектр долинных террас, составленный на основе данных геометрического нивелирования.

ON THE APPLICATION OF THE LANDSCAPE PRINCIPLE TO THE STUDY OF LAND RESOURCES

V. Lepasepp

The landscape principle in the study and evaluation of the natural conditions of agricultural production has been dealt with by a number of Russian and Soviet geographers and soil scientists, especially V. V. Dokuchaev, L. S. Berg, B. N. Vyssotski, B. B. Polynov and D. L. Armand.¹ They propounded the principle and were the first to apply it. The landscape principle has been widely introduced in the study of land resources during the past decade, especially following the decisions of the Central Committee of the C.P.S.U. on agriculture in 1953. The most outstanding work in this field is the research conducted in the theory and methods of application by the geographers at the universities of Moscow, Leningrad, Lvov, Voronezh and Riga.

In the Estonian S.S.R., little attention has been devoted as yet to either theoretical, methodological or practical questions of landscape science, although there is an urgent necessity and there are all the favourable preconditions for it. We have at our

¹ В. В. Докучаев: Место и роль современного почвоведения в науке и в жизни. *Ежегодник по геологии и минералогии России*, том 3, вып. 10, 1898. — *Idem*: Учение о зонах природы (Москва, 1948). — *Idem*: Наши степи прежде и теперь (Москва, 1953). — Л. С. Берг: Фации, географические аспекты и географические зоны. *Известия Всесоюзного Географического Общества*, том 77, вып. 3, 1945. — Г. Н. Высоцкий: О карте типов местопроизрастания. *Современные вопросы русского сельского хозяйства* (Санкт-Петербург, 1904). — *Idem*: О фитотопологических картах, способах их составления и их практическом значении. *Почвоведение*, No. 2, 1909. — Б. Б. Полюнов: Учение о ландшафтах. *Вопросы географии*, No 33, 1953. — Д. Л. Арманд: Качественная оценка земель — важнейшая народнохозяйственная задача географов. *Научные записки Львовского государственного университета*, том 40 (Львов, 1957). — *Idem*: Качественная оценка земель и кадастр земельных угодий. *Вопросы географии*, No. 43, 1958. — Д. Л. Арманд и А. В. Гедымин: Качественная оценка земель и организация территории (основные понятия). *География и хозяйство*, No. 7 (Москва, 1960). — Н. Л. Благовидов: Качественная оценка земель (Москва, 1960).

disposal rich materials on complex geological, geobotanic and soil investigations, as well as earlier experience in landscape study.²

The landscape principle has been extensively applied by the Department of Soil Research of the "*Eesti Põllumajandusprojekt*" (Estonian Agricultural Project) attached to the State Designing Institute in the study of soils — a sphere of work in which the present author has taken part during a number of years. The investigation of soils has here actually developed into the study of land on the landscape principle, especially in the hilly regions of South Estonia. Basing ourselves on the experience acquired in this research, and on the theoretical foundations of modern landscape science,³ we shall consider the essence of landscape science and the peculiarities of its application to the study and mapping of the land resources.

*

According to the landscape principle, in the investigation and evaluation of the land resources it is not units of separate components that are taken into consideration, but units of landscapes of different sizes (or taxonomic categories), i. e. territorial groupings of landscape components. That such units (natural territorial complexes) really exist in nature is now universally admitted, and has been convincingly proved by the investigation of nature itself. The whole surface of the Earth (landscape sphere) is composed of landscape units of very different sizes, all smaller units being organic components of territorially larger units and developing in conformity with the latter.

In researches into the natural conditions of the land resources smaller units of the taxonomic series of territorial units applied in landscape science, are described and mapped. Such landscape units are (1) *geographical facies* — the smallest units of landscape with the simplest relative structure constituting, according to some authors,⁴ the elementary or basic unit in the study of landscapes; (2) *minor natural regions (урочище, paigas)* — regular territorial groupings of facies, i. e. characteristic combinations of facies which typify a given form of the mesorelief;

² Э. Вареп: Физико-географическое (ландшафтное) районирование Эстонской ССР. *Труды четвертого Всесоюзного совещания по ландшафтоведению. Ученые записки Латвийского государственного университета*, том XXXVII (Рига, 1961). — К. Кильдема: Обзор исследований мелких географических комплексов в Эстонской ССР. *Известия Всесоюзного географического Общества*, том 94, вып. 3, 1962. — К. Кильдема, В. Лепасепи и А. Райк: Опыт ландшафтного исследования земельного фонда Эстонской ССР. *Материалы к VI-му Всесоюзному совещанию по вопросам ландшафтоведения. Вопросы ландшафтоведения* (Алма-Ата, 1963).

³ А. Г. Исаченко: Основные вопросы физической географии (Ленинград, 1953). — *Idem*: Ландшафтная съемка и составление ландшафтных карт. *Физико-географическое картирование*, часть III (Ленинград, 1961).

(3) localities — regular territorial combinations of minor natural regions which have developed on a certain morphogenetic type of relief (e.g. in a landscape with a hilly relief).

In the investigation of the soils belonging to the collective and state farms, which work is conducted by the State Designing Institute, the requirement has recently been⁴ put forth to indicate on the map parts of the territory which are practically similar with respect to their prospective agricultural utilization and are characterized by approximately the same productivity (i.e. oecological conditions for plant growth).⁵ Such demarcation of practically uniform sections of the land must take into account not only the soil (as is generally done), but also other components of the landscape, such as the relief (sloping microrelief), parent materials (thickness of the arable layer, depth of the bedrock, stone content), drainage, susceptibility to drought, the type of nourishing regime in cases of lands suffering from excessive moisture, the microclimate (the dangers of frost-blight, guaranteed optimal temperatures), as well as natural vegetation (in the case of meadows and forests).

It would be inexpedient to call such complexes varieties of soil, i.e. units of a single component, as is still frequently done. We prefer to call them units of landscape which in their size correspond to geographical facies. In the literature on the complex investigation of land, a vast variety of terms has been used to denote a landscape unit of more or less similar size, such as epimorph,⁶ micro-landscape,⁷ elementary landscape,⁸ land type,⁹ biogeocoenosis,¹⁰

⁴ В. И. Прокаев: Фация как основная и наименьшая единица ландшафтоведения. *Материалы к V-му Всесоюзному совещанию по вопросам ландшафтоведения* (Москва, 1961).

⁵ В. Лепасепп: О характеристике и учете геоморфологических условий при комплексном исследовании земельного фонда. *Сборник научных трудов Эстонской Сельскохозяйственной Академии*, No. 24 (Тарту, 1962). — Л. Рейнтам и И. Роома; Крупномасштабное картирование почв в Эстонской ССР и его дальнейшие задачи. *Сборник научных трудов Эстонской Сельскохозяйственной Академии*, No. 24 (Тарту, 1962).

⁶ Р. И. Аболин: Опыт эцигенологической классификации болот. *Болотоведение*, No. 3, 1914.

⁷ И. В. Ларин: Опыт определения по растительному покрову почв, материнских пород, рельефа, сельскохозяйственных угодий и других элементов ландшафта средней части Уральской губернии. *Труды Общества изучения Казахстана*, том VII, вып. I (Кзыл-Орда, 1926).

⁸ Б. Б. Полюнов, *op. cit.* [see footnote 1 above].

⁹ Л. Г. Раменский: Введение в комплексное почвенно-геоботаническое исследование земель (Москва, 1938).

¹⁰ В. Н. Сукачев: Фитоценология, биогеоценология и география. *Труды второго Всесоюзного географического съезда*, том I (Москва, 1948).

natural land or elementary patch of land,¹¹ soil phase in the USA,¹² etc. In the present paper, the term 'facies' introduced by L. S. Berg,¹³ and most widely used in the literature, is employed.

An essential criterion in the determination of a landscape unit of the size of a facies is the requirement of practical and also genetic uniformity. In other words, a facies must be practically uniform with other units of a corresponding size as regards all the separate landscape components, and at the same time typical of them.

For the compilation of small-scale landscape maps covering either administrative districts or the whole of the republic, landscape units larger than the facies (minor natural regions, localities) are determined. Larger units are detached and classified on the basis of an analysis of their genetic and territorial relations, as well as of the economic value of their smaller units. In the case of a more complicated landscape, it is expedient, and necessary, for the classification of the units of the size of a facies, to indicate also the minor natural regions and localities on detailed landscape maps of cultivated areas.

The determination, demarcation and classification of landscape units in mapping is one of the most difficult problems in the study of land reserves. In nature the landscape units merge almost invariably with transition areas or intermediate units and the cartographer has to find ways of distinguishing and separating them from one another. The existence of transition areas is due first and foremost to the fact that the boundaries of units of the same size constituting distinct components of a landscape do not always fully coincide in space, because the links between the components are not functional but correlative.¹⁴ In addition, the degree of variability of the components is different; not infrequently one component responds to a qualitative change in another only with a quantitative change, e.g. a plant community need not necessarily respond to a qualitative change in the soil with a change in its specific composition but only with a change in its vitality, etc., especially in transition areas.

Considering the above, and the experience drawn from the study of land, the principle of the leading factor is of great importance in the determination and demarcation of the landscape units. According to that principle, in the determination of the units to be mapped, priority is, as a rule, given to the features of one partic-

¹¹ Д. Л. Арманд, *op. cit.* [see footnote 1 above]. — Д. Л. Арманд и А. В. Гедымин, *op. cit.* [see footnote 1 above].

¹² А. В. Антипова и Г. М. Игнатъев: Качественный учет земель в США. *Вопросы географии*, No. 43, 1958.

¹³ Л. С. Берг, *op. cit.* [see footnote 1 above].

¹⁴ Д. Л. Арманд: Функциональные и корреляционные связи в физической географии. *Известия Всесоюзного географического общества*, том. 81, вып. 1, 1949.

ular component, depending on its importance in the articulation of the landscape and in the structure of the units to be distinguished.

The leading factor or component in a unit to be isolated is the one that determines and, in most cases, correlatively reflects the nature and properties of a whole series of other factors and on which, in the given regional conditions, the peculiarities and possibilities of effective and successful economic utilization depend most of all.

In the choice of the leading factor for the demarcation of the landscape units, one should be guided by the relative role the factor plays both in the nature of the landscape itself and in the peculiarities of its economic utilization, by its dynamics and its capacity to yield to the transforming action of man. In keeping with this, in the large-scale mapping of land, all the natural factors that come into consideration as influencing agricultural production can be divided into three groups (cf. the views of K. Briņkalns).¹⁵

1. Differential factors. Here belong the cardinal leading factors in the differentiation of landscape, (a) the relief, and (b) the mechanical and lithological composition of the parent material. The properties of the relief and the parent material of the soil are of relatively high stability and not easily subjected to transformation by man. That is why they serve as the principal basis for the differentiation of the landscape units. The nature and specific features of these factors must always be taken into account when choosing the mode of utilization and methods of cultivation of the land.

2. Differential indicator factors. Under this heading come less stable factors which are of secondary importance in the differentiation of the landscape; these are: (a) drainage (excessive moisture of the genetic horizons of the soil (A₂ and B), (c) pH of the soil, (d) stone content and (e) microrelief. The nature of these factors can be changed and unified mostly by means of meliorative measures. In the determination of the units of landscape, they serve as decisive factors in cases when essential features of the territory, which the scale of the map allows us to indicate, are reflected in the properties of these factors in an area uniform as regards its relief and the parent material. If the scale does not permit the differentiation of smaller units, these factors are generalized within the limits of the units determined on the basis of differential factors either as a complex or according to the prevailing property.

3. Indicator factors. This group comprises the factors which serve as a basis for the differentiation of landscape units only in

¹⁵ К. Бриņкалнс: Проект качественной оценки земель Латвийской ССР. *Почвоведение*, No. 6, 1959.

exceptional cases in landscapes of very simple morphological structure. Such factors are: (a) thickness of the humus layer, (b) structure of the soil, (c) content of free plant nutrients in the soil, (d) specific composition and structure of the biocoenosis. The properties of these factors usually show high territorial variability and are readily modified by agrotechnical measures. These factors serve as complementary indicators relative to the factors of groups 1 and 2 in the determination of the degree of fertility and cultivability of a unit of landscape.

Thus it is for the most part only factors of the first and the second group that count as leading factors in the territorial demarcation of the landscape.

The general leading principle here is as follows: any less essential and more readily varied factor serves as a basis for the differentiation of separate contours on a given scale only in cases where the factors tending to invariability (differential factors) are practically uniform over a given area. A natural factor is to be considered practically uniform when, in the given regional conditions and scale, in a classification based on this factor, its properties vary only within the limits of one degree or unit.

As in different regional conditions (including also types of landscapes) the relations between the factors of landscape are variable, it proves expedient to differentiate accordingly also the methods of investigation of the land resources. In different physico-geographical conditions, the leading factors for the determination of the units to be mapped, are usually different. It also happens that for the description of a particular factor, one has to go into different degrees of detail, depending on its importance in the landscape and on its application in the given region.

In the conditions of the Estonian S. S. R. it is expedient to differentiate the methods of studying the land reserves on the basis of four different regions (types of landscapes) as follows:

1. South Estonian landscapes with hilly relief (the relief being the basic leading factor);

2. Central and South Estonian ground moraine and outwash plains (the leading factors being the mechanical and lithological composition of the parent material and the genetic properties of the soil).

3. North Estonian limestone plains (the main distinguishing factors being most frequently the properties of the parent material of the soil — thickness of the plough layer, depth of the bedrock, stone content).

4. West Estonian lowlands of sedimentary origin (the main distinguishing factors are the mechanical composition of the parent material and moisture content).

*

As an example, let us consider the application of the landscape principle in the detailed mapping of the hilly lands of South Estonia. As mentioned above, it is first and foremost the relief that serves as the distinguishing factor for the differentiation of the landscape units here. Therefore it was necessary to elaborate a system of classification for the relief conditions best suited for the given landscape. As on a hilly landscape, in view of both agricultural production and the structure of the landscape, an important role is played by the angle of inclination of the slopes,¹⁶ this was chosen as the chief basis for the description of the relief conditions.

In establishing the angle of inclination we have mainly taken into account the danger of erosion if the land is to be put to agricultural use, but also the peculiarities of drainage, the efficiency of the exploitation of the tractor, and, in the light of the aforesaid, the necessity for the differentiation in the nature of land utilization and agrotechnical measures to be applied. It is of interest to note that in the typical hilly landscape on the Heights of Haanja nearly 22 per cent of the arable lands lie on rather steep slopes (12—20°), 58 per cent cover hillsides with moderate declivity, and barely 20 per cent have little or very little inclination (up to 6°). It goes without saying that in such conditions the relief, together with the properties of the soil must be taken into account as factors of utmost importance for the evaluation of the land and for the elaboration of a rational system of utilization of the land reserves.

In field work and when mapping hilly landscapes, a special index system is used to denote the natural features of the contours to be distinguished. We show, for instance, the slope, the degree of erosion, the mechanical composition of the soil, stone content, etc. In the demarcation of the contours, the relief conditions count as the most important. In the first place, the concave elements are distinguished from the convex ones. Then the convex or positive elements are classified according to the slope. The scale of the map permitting, they are further classified on the basis of the variety and the mechanical composition of the soil. If the scale does not allow further and more detailed division, or if it proves practically unnecessary, it is sufficient to indicate the prevailing variety and the mechanical composition (or a corresponding complex) on the contour.

The concave or negative elements of relief are first grouped according to the degree of moisture and the type of bogs: distinctions are made between floodlands of moderate moisture, moist, wet and peat soils, and soils of fens, mesotrophic peat-lands and raised bogs. If the scale of the map does not allow the differentiation of all the degrees of moisture and types of bogs, only the predominating degree of moisture, or type of bog, together with the prevailing

¹⁶ B. Лепасепп, *op. cit.* [see footnote 5 above].

soil (in some cases also the corresponding complexes) is indicated.

The application of the landscape principle to the study of the land resources gives rise to the necessity of elaborating new principles for drawing maps, different from those used in drawing maps of one component (e.g. soils) of the landscape. According to the landscape principle, maps of the so-called analytico-synthetical type are compiled for large-scale mapping of the land reserves. Such maps are also called complex soil maps or, traditionally, merely soil maps, although essentially they are landscape maps. The above-mentioned maps are compiled on the following principles:

1. Different colours are used on the map to present groups of elementary units (geographical facies) depending on the nature of the leading factor, i.e. convex relief elements according to their slope, concave ones according to the degree of moisture and the type of bog, plains of moderate dampness (declivity $< 2^\circ$), however, according to the degree of podsolization.

2. Coloured shading and special signs or marks are used on the map to denote the mechanical composition, the degree of decomposition of peat and the pH. The shaded areas and topographical marks show the mechanical composition of the soil, and, in case of marshes, the degree of decomposition of peat. The colour of the shading and of the marks, however indicates the pH in the arable layer of the soil at a depth of 50—60 cm. Four different colours are used: blue for carbonaceous soil, green for pH_{KCl} above 5.5; orange for pH_{KCl} 5.1—5.5; and red for pH_{KCl} below 5.1.

3. Ciphers are used to mark the different varieties of soil and their complexes.

4. Special symbols are used to mark steep slopes (with an angle of inclination $> 20^\circ$), gullies, spots rich in boulders, the degree of stone content, springs, quagmires, etc.

5. Arabic figures (in red ink) mark in each separate contour (in the case of farm land) the quality of the soil according to the system of 100 points applied in our republic in experimental land valuation.¹⁷

6. The legend of the map is given in the form of a table in which each coloured unit is given complex characterization (from the standpoint of the landscape) together with the soil capability class and recommendations for utilization. Such a landscape map of the analytico-synthetical type offers a complex characterization of the natural conditions of the land and of the preconditions

¹⁷ R. Kask and R. Pant: Maadehindamise metoodikast ja muldade boniteerimisest Eesti NSV-s [Methods of land assessment and the quality classification of soils in the Estonian S.S.R.]. *Sotsialistlik Põllumajandus*, Vol. XVI, No. 6 (Tallinn, 1961).

for agricultural production. It should serve as a basic document for making an inventory of the land reserves, as well as for the solution of such practical questions in connection with land cultivation as local specialization, the distribution of forests and arable lands, the determination of the structure of the area to be sown to crops; the elaboration of a complex of meliorative and agrotechnical measures, etc.

In order to take various agrotechnical and meliorative measures on the farms, it is possible, on the basis of a given map, to compile simplified specialized cartograms, e.g. on the prospective drainage work, stone content, danger of erosion, lime requirement, capability class, etc. The nomenclature of the latter depends on the concrete natural conditions and the needs of the farm. However, when drawing these cartograms and considering the prospective application of certain meliorative or agrotechnical measures, all the essential components of a landscape must be taken into account in their territorial interrelation and interdependence.

Let us consider the advantages of such landscape maps as compared with maps of a single component (soil, vegetation, relief, etc.) from the point of view of agricultural production.

1. On an applied landscape map, all the natural features influencing agricultural production are presented in their corresponding territorial communities (as units of landscape) and in the most rational form for practical use, i.e. the most essential or leading factor for each unit in the given conditions has been specially emphasized. The secondary territorial differences are made prominent.

The one-component maps, however, give prominence to the properties of one component of the landscape only, regardless of whether these properties are at all essential for the agricultural utilization of the landscape unit. Thus, for instance, on slopes exceeding 6° in a hilly landscape, the mode of land exploitation and the agrotechnical measures are not so much determined by differences in the soil properties, but by the relief conditions. On the plains, however, the genetic properties of the soil are of real importance.

2. The possibilities for practical use of such a landscape map are considerably more extensive than of a one-component map of any kind. A landscape map allows one to take into account the largest variety of natural prerequisites for the application of any means in production or for the choice of a measure to be taken in land utilization. Although it is often the properties of only a single component (such as the soil) that dictate the particular measures, one should always consider also the peculiarities of other components of a given landscape unit. Taking a step in land utilization (either surveying, meliorative or agrotechnical) presupposes a

more or less exhaustive interpretation of the given natural conditions as combined in a landscape.

Even to determine, for instance, the need for phosphate fertilizers in a soil, one cannot rely only on the amount of assimilable phosphates in the soil. In order to determine the actual need for a fertilizer for the growth of a particular crop it is necessary to take into consideration the pH of the soil, its mechanical composition, the presence of other plant nutrients, etc. The same must be borne in mind when determining the lime deficiency, when estimating the draining requirements and possibilities, when envisaging anti-erosion measures, etc.

3. The demarcation and classification of landscape units of different sizes furnishes a scientific basis also for the elucidation of the laws and influences governing the properties of the individual components of a landscape. It also makes for a better understanding of the regional peculiarities. As yet the features and functions of soils, vegetation, relief and other components as combined in a landscape are generally insufficiently known. Naturally the properties of the individual components should be studied against the background of landscape units and inseparably from them.

It is one of the aims in the study of landscapes, apart from the demarcation and study of landscape units as natural territorial components, to examine these individual components according to their role in the landscape as a whole. It is on this that their special value largely depends. At the same time, such investigations reveal what some modern geographers call "the physiology of a landscape". But it is only the perception of the "physiology" and dynamics of the landscape units that creates a scientific foundation for the determination of their potential productivity and practical utilization, for their transformation in the interests of man.

In view of what has been said above, the landscape principle should find ever increasing application in research into the natural conditions of the land reserves, including both the study of the properties of the individual components and complex investigation. More and more methods of landscape study and mapping should be introduced. That will create prerequisites for the development of a comprehensive classification of landscapes based on the theoretical foundation of the science of landscapes and serve the interests of the national economy, especially of agriculture. Our republic has already sufficient prerequisites for the completion of such a comprehensive typology of landscapes, but a common effort by all naturalists is required. The landscape and soil scientists, silviculturists, geobotanists, climatologists, agronomists and workers in

hydromelioration, in particular, should work in close collaboration. The elaboration of a comprehensive landscape typology should become one of the urgent problems of today for our naturalists, and, above all, for our geographers.

MAASTIKULISE PRINTSIIBI RAKENDAMISEST MAAFONDI UURIMISEL

V. Lepasepp

Resümee

Nõukogude maastikuteaduse teoreetilistele alustele ning Eesti NSV mullastiku kaardistamise praktilistele kogemustele tuginedes põhjendatakse artiklis maastikulise printsiibi rakendamist põllumajanduslike majandite maafondi uurimisel ning käsitletakse maafondi maastikulise uurimise ja kaardistamise metodoloogilisi lähtekohti. Konkreetse näitena maastikulise printsiibi rakendamise kohta maafondi uurimisel käsitletakse RPI «Eesti Põllumajandusprojekt» kompleksset mullastiku uurimist Lõuna-Eesti künklikus moreenmaastikus. Samas antakse ülevaade autori poolt propageeritavate analüütilis-sünteesilist tüüpi maastikukaartide (komplekssete mullastikukaartide) koostamise ja vormistamise põhimõtetest ning tõstetakse esile nende kaartide eeliseid ühe maastikukomponendi (mullastiku, taimkatte, reljeefi jt.) kaartidega võrreldes mitmesuguste põllumajandusliku tootmisega seotud praktiliste küsimuste lahendamisel.

О ПРИМЕНЕНИИ ЛАНДШАФТНОГО ПРИНЦИПА ПРИ ИССЛЕДОВАНИИ ЗЕМЕЛЬНОГО ФОНДА

В. Лепасепп

Резюме

Опираясь на теоретические основы советского ландшафтоведения и на опыт картирования почв в Эстонской ССР, автор в статье обосновывает применение ландшафтного принципа при исследовании земельного фонда сельскохозяйственных предприятий, а также рассматривает методологические исходные положения ландшафтного исследования и картирования земельного фонда. В качестве конкретного примера применения ланд-

шафтного принципа исследования земельного фонда рассматривается комплексное исследование почв на холмисто-моренном ландшафте Южной Эстонии, проводимое ГПИ «Эстсельхозпроект». При этом дается обзор принципов составления и оформления ландшафтных карт аналитически-синтетического содержания (комплексных почвенных карт), составляемых в результате этих исследований, а также подчеркиваются преимущества таких карт в сравнении с картами одного природного компонента (почвы, растительность, рельеф и др.) при решении разных практических задач земледелия.

ON THE ECONOMIC REGIONALIZATION OF THE ESTONIAN S.S.R.*

S. Nõmmik

The planned and rational character of socialist construction work is ensured by the perspective plans of the development of the national economy and culture, which are based on the objectively existing system of economic regions. It follows from the above that the territorial planning of the socialist national economy can only be thought of as inseparably linked with economic regionalization.

The practical aim of economic regionalization is to establish a system of economic regions which would ensure the potentially maximum social capacity for work and, in the case of its application, the maximum social productivity of labour with the least expenditure of labour and capital.¹ Economic regionalization, however, is a historical category. Its aim, tasks and methods change with the development of the needs of society. The all-round construction of communism is characterized by a highly rapid development of all spheres of life. The amount of capital investment in the national economy and cultural institutions is growing every year. Every cause which is initiated today will serve our society not only today and tomorrow, but will be a link in the structure of communism. It is, therefore, necessary to consider every initiative not only in the terms of the present but also from the aspect of the future, and to forecast the future possible shifts in the territorial structure of the productive forces. Every task of planning the national economy constitutes an economic, technical and territorial whole where it is absolutely necessary to consider every individual constituent part. The tasks of laying the technical and material foundation of

* The present paper represents a revised version of an original article by S. Nõmmik: Eesti NSV majanduslikust rajoneerimisest. *Geograafia-alaseid töid II. Tartu Riikliku Ülikooli Toimetised*, fasc. 128 (Tartu, 1962), pp. 35—141.

¹ В. М. Четыркин: О районообразующих признаках в советском экономическом районировании. *Вопросы географии*, Vol. 41 (Moscow, 1954), p. 27.

communism require considerable improvement in the methods of territorial planning.

In the course of the past decade regional planning of districts (*районная планировка*) has made rapid progress in our country. It embraces, first, the perspective planning of all our social life, including the sphere of production as well as the sphere of catering, taking into account the natural conditions and resources; second, the existing basis of production as well as the network of institutions catering for the everyday material and cultural needs of the people. District planning is a new method of the complex territorial planning of the national economy, which is best adapted to the tasks of laying the material and technical foundation of communism.

District planning makes it necessary for specialists in different spheres to co-operate with the aim of achieving a common goal. Such regional plans have been or are being drawn up for industrial centres revealing the tendency of a particularly rapid development (e.g. the Kuzbas, the Donbas, etc.). It would be, however, ideal if such territorial plans were drawn up for all the parts of the Soviet Union. It is the task of economic geographers engaged in regional planning to give a more detailed complex economic regionalization of the whole country.

Until quite recently the problems of the general economic regionalization of the territory of the U. S. S. R. were the focal point of Soviet economic geography. Nevertheless, research into this field cannot be regarded as finished. On the contrary, this work must be continued so that the changes in the social and territorial division of labour may find reflection in the system of economic regions. In connection with the development of regional planning, Soviet science has begun to take greater interest in detailed economic regionalization (within the limits of oblasts and small Union Republics) and in the ascertainment of intra-regional differences. The importance of detailed economic regionalization has increased particularly in conjunction with the drawing up of a perspective plan for the development and distribution of the national economy of the U. S. S. R.

Economic regionalization within oblasts starts from the general principles of Soviet general economic regionalization. But compared with the latter, the economic regionalization of an oblast has its specific features. The former differs from the latter in the degree of generalization, being less generalized and more concrete in its features. The chief criteria of Soviet economic regionalization are the territorial differences in the specialization of economic life and the possibility of its complex development. Production complexes of economic regions within oblasts represent inseparable parts of territorial production complexes of a higher order. In the establishment of economic regions within oblasts, apart from specialization

and the possibilities of complex development, a number of other characteristics have to be taken into account. These characteristics, as it were, are apt to be levelled out in the broad generalizations of economic regionalization on a larger scale.²

An economic region within an oblast (or within a Union Republic which is too small to include oblasts) represents a part of the territorial production complex of a given oblast objectively existing and performing specific functions, whose specialization reflects one aspect of the specialization of the whole. When trying to ascertain economic regions within an oblast, the specific features of the formation of towns as production and exchange centres as well as the establishment of the range of their hinterland acquire special weight. This is because the communication between a town and its hinterland represents an essential factor leading to the formation of an economic region. A basic characteristic of regionalization within an oblast is the distribution of the population as well as of the labour reserves, the distribution of the housing resources, the socio-cultural factors and the functions of catering for the everyday material needs of the people, along with the natural conditions and resources.

It follows from the above that the problem of the complex economic regionalization of a small Union Republic possesses two aspects. On the one hand, it takes into account the place of the given Union Republic in the general economic regionalization of the U.S.S.R., and on the other hand, it concerns the internal economic regionalization of the Republic.

I The place of the Estonian SSR in the general economic regionalization of the Soviet Union

The Estonian S. S. R. joined the U. S. S. R. in 1940. As a result, the Estonian S. S. R. became an inseparable part of the Soviet Union and as such the development of its national economy and culture is subject to the effect of the objective laws of development of a socialist society, the basic economic law and the economic laws deriving from it, primarily the law of planned development of the economy. As has already been pointed out, economic regionalization is an absolutely necessary basis and pre-condition of the territorial planning of the socialist national economy. After the Estonian S. S. R. had joined the U. S. S. R., there inevitably arose the question of her place in the planned economy of the Soviet Union and in the general economic regionalization.

² И. В. Комар, М. И. Помус и С. Н. Рязанцев: О внутриобластном районировании. *Материалы к III съезду Географического общества Союза ССР* (Leningrad, 1959).

When the Baltic countries joined the Soviet Union, its peoples were already engaged in the realization of the tasks set before them by the Third Five-Year Plan. The Third Five-Year Plan had already been drawn up for the Russian Federation by economic regions; for the other smaller Union Republics individual plans of development of the national economy were drawn up. Taking into account certain common features in the specialization of the national economy of the Baltic Union Republics and the Byelorussian S. S. R., these were united into the Western economic region of the Soviet Union in October, 1940.³

The extremely rapid development of the national economy of the U. S. S. R. in the post-war years brought about great shifts in the geographical specialization of the economy. The growth of the old branches of production and the rise of new ones involved a further economic differentiation of the individual parts of the U. S. S. R. and produced changes in the economic links within the regions themselves as well as in their mutual relations. This process manifested itself also in the Western economic region of the U. S. S. R. Objective reality showed that the Baltic Union Republics and the Byelorussian S. S. R. differed considerably in their specific features of production, as well as in their problems of development, and that their amalgamation in a single economic region needed revision. In 1961, the Baltic Union Republics were separated from Byelorussia and alone constituted the Western economic region of the U. S. S. R.⁴

The decisions of the Plenary Meeting of the Central Committee of the C. P. S. U. in November, 1962, provided for the continued improvement of the management of the national economy and the betterment of territorial organization. The reorganization of the system of national economic councils was followed by the reorganization of the system of economic regions. As a result, the State Planning Commission of the U. S. S. R. plans the national economy of the entire country in relation to its 18 economic regions. In connection with these reorganizations Kaliningrad Oblast was incorporated into the Western economic region.⁵

The three Baltic Union Republics (the Estonian S. S. R., Latvian S. S. R., and Lithuanian S. S. R.) and the Kaliningrad Oblast, which now together constitute the Western economic region, have much in common in the historically formed specialization of the national economy as well as in their natural conditions. The Western economic region of the U. S. S. R. is a typical example of

³ П. М. Алампиев: Экономическое районирование СССР (Moscow, 1959), p. 178.

⁴ С. Токарев и П. Алампиев: Вопросы совершенствования территориальной организации народного хозяйства и экономическое районирование. «Плановое хозяйство» 1961, No. 7, p. 31.

⁵ «Плановое хозяйство», No. 11, 1963, p. 89.

how Soviet economic regionalization becomes a factor in the re-making of the economic life of a region. Originally the different parts of the Western economic region were only slightly connected with one another, and economic co-operation among them was feebly developed. However, the creation of the Co-ordinating Council of the Western economic region and of a common planning committee produced pre-conditions for the strengthening of co-operation within the different parts of the region and the ensuring of their complex development. A concrete expression of this co-operation is specialization within the national economy, particularly in industry, with the aim of speeding up the growth rate of social labour productivity. This co-operation will become closer also in the fields of science and culture. All this is a concrete expression of the objective process of the complex development of the region.

The production complex of the Western economic region is characterized by the leading role of those branches of industry that need the most labour reserves, plus intensive farming and the management of ports, fisheries and seaside health-resorts resulting from the maritime position of the region. In spite of the relatively dense population in this region, the shortage of man-power makes itself felt here, compelling one, when taking decisions on the problems of development of the national economy, to lay emphasis on the branches of production requiring little, though qualified man-power. It also demands further mechanization and automation in industry as well as agriculture. Compared with the other Baltic Union Republics, the strain on man-power is particularly great in the Estonian S. S. R.

II The internal economic regionalization of the Estonian S. S. R.

1. On the need for economic regionalization within the Republic

The territory of the Estonian S. S. R. is small. Doubts have sometimes been expressed as to whether there is any need in such a small country for economic regionalization. In reply to this question it must be pointed out that the need for economic regionalization does not depend on the size of the territory of a country, but on the degree of differentiation of the economy (on the territory of a given country). On an economically backward territory with a uniform natural basis, regional differences in the economy are smaller; in the case of a well-developed and many-sided economy, the local specific features of the economy are more pronounced and vary considerably from place to place. This circumstance makes it necessary to ascertain by the method of economic regionalization the objectively existing differences and problems of development also on small territories with highly developed productive forces.

The Estonian S. S. R. belongs to such territories and here, as in other Union Republics, economic regionalization is the pre-condition of a better territorial organization of the socialist national economy. The individual parts of the Republic differ from each other in the specific features of their productive activities and the problems of development of economic life. Each of them has different pre-conditions and plays a different role in the geographical distribution of the productive forces.

The territorial planning and guidance of the national economy of the Estonian S. S. R. are mainly based on the administrative territorial division of the Republic. But though socialist administrative and territorial divisions, as well as economic regionalization, are developing hand in hand, they have different tasks.

Soviet administrative territorial organization takes account of the natural and historic conditions prevailing in a particular territory, considers its economic profile, and is closely connected with economic development and planned guidance. But the prime task of Soviet administrative and territorial division is to facilitate the implementation of the functions of the socialist State in conditions of Soviet democracy. The administrative and territorial division of the State, however, undergoes comparatively rapid changes and its development is largely dependent on the tasks facing the State at a given moment. Due to its changeability the administrative territorial division cannot serve as a firm foundation for the planning of the complex development of the economy, particularly in its remote perspective.

As has been mentioned above, the formation of economic regions is an objective process which must be reflected in complex economic regionalization. The "discovery" of economic regions lies in the correct understanding, ascertainment and establishment of this objective process according to the general laws of development of a given social and economic structure. The task of economic regionalization is to properly establish the territorial complexes of production which have been historically formed, to study their structure, the internal and inter-regional specialization of their economy. Complex economic regionalization, which is the foundation of the complex development of the economy of these regions, is a necessity which stems from the essence of socialist planned economy.

It will be evident from what has been said above that the administrative division of a territory cannot perform the functions of complex economic regionalization or render economic regionalization unnecessary. Complex economic regionalization will help to secure the many-sided development of even those regions which differ in their economy and natural resources. It helps to direct purposefully the allocation of capital investments by taking into account the co-ordinated interests of all the branches of the national

economy, as well as to effect the rational geographical specialization of economy in the Republic. The problem of the economic regionalization of the Republic will have to be tackled urgently, as regional planning has already been placed on the agenda.

2. Previous experience in the complex regionalization of the Estonian S. S. R.

After the Estonian S. S. R. had joined the U. S. S. R. essential shifts took place in the structure and the distribution of the national economy. These shifts were due to the changed social conditions. The (vertical) development of the different sectors of the national economy was accompanied by the (horizontal) development of the national economy in the districts. The rise of new branches of production in addition to the previous ones strengthened the relationship between the various sectors of the economy. It brought about an economic differentiation of the parts of the Republic in accordance with the tasks allotted by the State and the economic and natural conditions that had taken shape in the course of the past history. In reality this process implied the formation of economic regions that were socialist in essence. The recognition of this process, the detection and proof of the objective existence of these economic regions, in other words the economic regionalization of the Republic, was a problem that could only be solved by economic geographers.

The first attempt at a solution of the economic regionalization of the Estonian S. S. R. was undertaken by V. Tarmisto, who distinguished three economic regions on the territory of the Republic: 1. Northern Estonia, 2. Central and South-Eastern Estonia, and 3. Western Estonia. This scheme underlies many of his works.⁶ This attempt on the part of V. Tarmisto was acknowledged as the first effort to effect a complex economic regionalization of the Republic, which brought out the existence of essential differences in the distribution of the productive forces in the Republic. At the same time such a solution elicited divergence of opinion on many points.

In 1959 the author of the present paper propounded another possible scheme for the economic regionalization of the Republic.⁷

⁶ V. Tarmisto: Nõukogude Eesti majandusgeograafilisest rajoneerimisest. [On the Economic-Geographical Regionalization of Soviet Estonia]. *«Nõukogude Kool»*, No. 3 (Tallinn, 1954). — V. Tarmisto and M. Rostovtsev: Eesti NSV. Majandusgeograafiline ülevaade [The Estonian S.S.R. An Economic-Geographical Survey] (Tallinn, 1956). — М. И. Ростовцев и В. Ю. Тармисто: Эстонская ССР. Экономико-географическая характеристика (Moscow, 1957).

⁷ С. Я. Ныммик: К вопросу об экономическом районировании Эстонской ССР. *Вестник Ленинградского университета, Серия геологии и географии*, Vol 24. fasc. 4. (Leningrad, 1959), pp. 99—110.

She distinguished five regions with different specific features of production and with their own problems of development. These are Northern, North-Eastern, South-Eastern, and South-Western Estonia, and the western islands of the Republic. The author's scheme of economic regionalization took into account the specialization of the Republic's national economy and the problems of development, as they had been set forth in the Fourth, Fifth and Sixth Five-Year Plans. In the meantime, however, a number of changes had been effected in the administrative territorial division of the Republic, the perspectives of the further development of the economy of the different parts of the Republic had been slightly readjusted. This made it necessary to subject the whole problem to reexamination. The practice of the national economy and further scientific research showed that the differentiation of five economic regions corresponded to objective reality, but corrections had to be made in the boundaries of these regions (Fig. 1).

The economic regions are separated from each other by borderline territories, which have no well-established links with any of the regions. The attribution of such territories to one or other region depends on many circumstances, such as the administrative division, the nature of the existing economic links, etc. In connection with various reassessments of the role of the various sectors of the national economy, the problem of borderline territories appeared in a new light.

Practice has shown that the boundary between Northern and South-Western Estonia in our scheme had been given correctly. Its correctness was corroborated by the subsequent reform of the administrative and territorial division of the Republic. But corrections had to be made in the delimitation of the boundaries of North-Eastern Estonia. Due to the alterations in the fuel budget of the north-western section of the Russian Federation, which were connected with the introduction of natural gas from other regions, the prospects of the Estonian oil-shale industry changed in some degree. The future development of the oil-shale industry will chiefly proceed along the lines of the complicated processing of oil-shale for the production of various kinds of synthetic raw materials. The organization of such production generally needs a limited, but skilled labour force. On the other hand, the demand for man-power will diminish on account of the rapid mechanization and automation of labour operations in the near future. This is why a particularly big increase in the population of North-Eastern Estonia is not envisaged.⁸ In its turn, this will render unnecessary the expansion of the agricultural hinterland of North-

⁸ А. Марксо: Проблемы формирования и размещения северо-восточного экономического района Эстонской ССР. *Geograafia-alaseid töid II. Tartu Riikliku Ülikooli Toimetised*, fasc. 128 (Tartu, 1962), pp. 35—141.

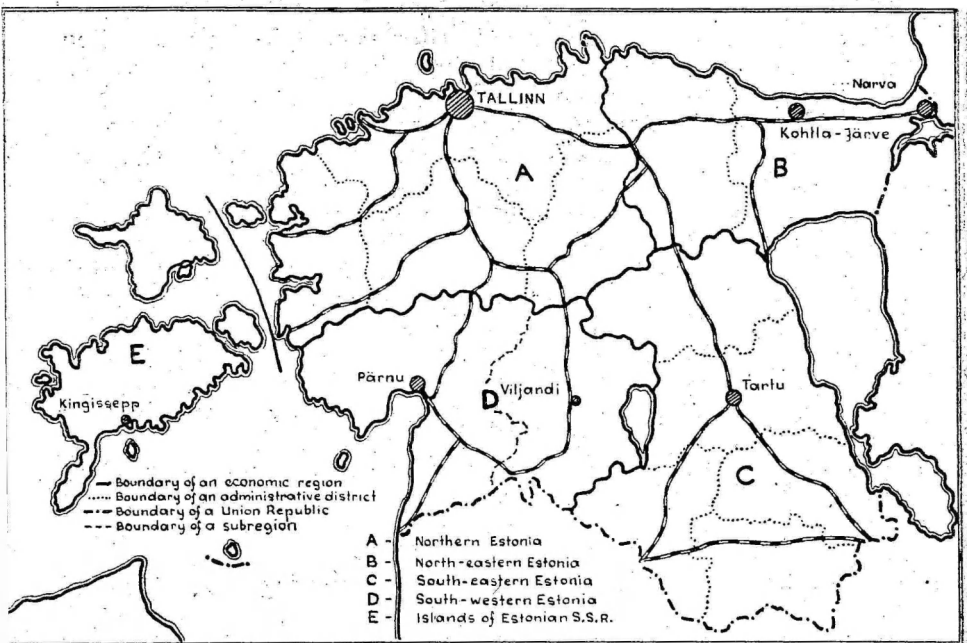


Fig. 1. Economic regionalization of the Estonian S.S.R.

Eastern Estonia at the expense of the administrative districts of the central part of the Republic. However, the need for an alteration of the boundaries of North-Eastern Estonia has been pointed out by A. Saar.⁹

Further studies likewise brought out the need for shifting the boundaries of the economic region of South-Eastern Estonia further to the north and to the north-west.¹⁰ Although the administrative-district of Jõgeva represents a certain border-line territory, its inclusion in the economic region of South-Eastern Estonia is justified by the economic links that it maintains with Tartu, the centre of South-Eastern Estonia.

The separation of the western islands of Estonia from the other parts of the Republic and their singling out into an independent economic region is somewhat conditional. The western islands are

⁹ A. Saar. Mõningaid Eesti NSV majandusliku rajoneerimise küsimusi. Summary: Some Problems Concerning the Division of the Estonian S.S.R. into Economic Regions. *Eesti Geograafia Seltsi Aastaraamat 1960/1961*. (Tallinn, 1962), pp. 225—246.

¹⁰ С. Я. Ныммик: К вопросу изучения хинтерланда города. *Вопросы географии городов Прибалтики. Публикации Эстонского географического общества V* (Tallinn, 1962), pp. 55—72.

economically not closely connected with one another and do not represent an internally uniform territorial complex of production. Nevertheless, they are connected through common specialization and the uniformity of their problems of development, which is essentially due to their insular position and demands a different approach to the organization of the economy of that part of the Republic. The singling out of the western islands into an independent economic region becomes necessary if we take into account the needs of regional planning.

The present scheme of economic regionalization of the Republic has found recognition in a number of other authors¹¹ who acknowledge the objective existence of five economic regions differing from one another in their specific features of production, in the level of development of the complex of production as well as in the problems of development and the prospects. They also differ from one another in the role which they play in the inner-Republican territorial organization of the productive forces, not to speak of those of the Soviet Union as a whole.

III Brief characterization of the economic regions of the Estonian S. S. R.

1. Northern Estonia

Northern Estonia ranks as the first industrial region of the Republic, a region characterized by the manufacturing industry where agriculture primarily serves the local industrial centres. A closer analysis of the distribution of the productive forces shows that Northern Estonia may be regarded as including the city of Tallinn and the administrative districts of Harju, Haapsalu, Rapla and Paide. This constitutes more than one-fourth of the total territory of the Republic and comprises two-fifths of the Republic's total population and over a half of the Republic's urban population. Over two-fifths of the Republic's industrial workers have been concentrated in Northern Estonia, and it accounts for approximately a half of the industrial output of the Republic. If we add the fact that Tallinn is the capital, with political and cultural functions embracing the whole Republic, we can justly treat Northern Estonia as the leading economic region of the Republic.

The chief factor accounting for the formation of Northern Estonia was the rise of an agglomeration of industrial enterprises in Tallinn, which in the course of a nearly century-long development merged with the agricultural hinterland in its vicinity into an

¹¹ A. Saar, *op. cit.* [see footnote 9 above]. A. Marksoo, *op. cit.* [see footnote 8 above].

integral territorial complex of production. This process was, in addition, promoted by the administrative functions of Tallinn with regard to its nearer as well as its remoter hinterland and its favourable geographical position.

The rapid development of industry in Tallinn in the last quarter of the nineteenth century and at the beginning of the twentieth century was not so much due to the development of the local productive forces as to the overseas trade of tsarist Russia which made use of the local pre-conditions. These included, on the one hand, the favourable geographical position of Tallinn on both coast and frontier — a junction of sea and land communications; on the other hand, the experience gained by the urban population in processing metal and textile raw materials. By the beginning of the present century Tallinn had become the centre of a highly diverse manufacturing industry which was characterized primarily by the machine-building and textile industries operating with fuels and raw materials (coal, metal, cotton) imported from abroad (Great Britain and the United States of America). By 1917, 54% of the total number of factory workers in Estonia had been concentrated in Tallinn, the metal-workers accounting for 85% of them.¹² At the turn of the century the industrial enterprises started to make more extensive use of the local resources (timber, agricultural produce) as industrial raw materials. At the same time there began the process of a closer association of the nearer hinterland with industrial Tallinn. The prominent place that the cellulose and paper industries occupied in the structure of industry in Tallinn testifies to this.¹³ The development of certain food industries (meat and dairy produce), both in Tallinn and outside of it, also points to a more extensive inclusion of the local resources in economic circulation. The closer economic association of Tallinn with its environs (in the way of the transport of foodstuffs and raw materials, commercial servicing) was largely furthered by the dense radial network of highways and railways, as well as by the administrative functions of Tallinn in its capacity as a governmental and provincial centre.

The character of Tallinn as an industrial centre underwent serious changes in bourgeois Estonia. Tallinn was first of all hit by a serious decline in the heavy industry intended to serve the all-Russian market and by the disintegration of the heavy industry into a great number of small enterprises serving the local market.

¹² A. Takkin: Tallinna tööstustöölise majanduslikust ja poliitilisest olukorrast 1914.—1917. a. [On the Economic and Political Status of the Industrial Workers of Tallinn in 1914—1917]. *Eesti NSV Teaduste Akadeemia Toimetised, Ühiskonnateaduste seeria*, Vol. VIII, No. 2, p. 139.

¹³ В. Ю. Тармисто: О некотором опыте экономико-географического исследования промышленных центров (на основе материалов г. Таллина). *Вопросы географии городов Прибалтики. Публикации Эстонского географического общества V* (Tallinn, 1962), p. 77.

The concentration of industrial enterprises in Tallinn continued. In 1939, 48% of workers engaged in the large-scale industry of bourgeois Estonia were concentrated in the capital; this total included about 76% of the metal and machine-building workers, approximately 30% of the workers engaged in the building-materials industry, over 58% of the timber and wood workers, about 60% of the pulp and paper workers, over 40% of the textile workers and 77% of the workers engaged in the food industries.¹⁴ On the other hand, the turn in the direction of the light industry and the growth of the role of the industry based on the local raw materials¹⁵ allows us to infer the consolidation of economic links between the capital and its hinterland.

Since it was chiefly the West-European countries, the U. S. A., Sweden, and Finland that were partners of bourgeois Estonia in foreign trade,¹⁶ nearly all of it was concentrated in Tallinn. Agricultural products and products of wood processing, the production of which also played an outstanding role in the industrial structure of Tallinn, dominated foreign trade. Hence it was natural that the consolidation of the economic links between Tallinn and its hinterland should continue.

A few industrial enterprises arose on the basis of local raw materials outside Tallinn (at Kehra and Maardu). Regardless of that fact there was a sharp contrast between the distribution of the productive forces in Tallinn and in its vicinity — on the one hand the almost complete concentration of industrial enterprises in Tallinn, on the other hand the almost completely agricultural hinterland.

In the conditions of Soviet power the contours of Northern Estonia have taken on a still more definite shape. Tallinn has remained the leading core of the economic region as before. By 1958 the overwhelming majority of the Republic's machine-building and metal-processing industries, building-materials and wood-working industries, pulp and paper industries had become concentrated here. On the basis of data from the same year, over 40% of the workers engaged in the Republic's large-scale industry worked in the capital. But compared with 1939, a decrease in the overall role of Tallinn in the industry of the entire Republic can be noticed. This decrease was first of all due to the development of industry in other parts of the Republic. But in keeping with the principle of the complex development of socialist production, Tallinn as an indus-

¹⁴ V. Tarmisto; Muutustest tööstuse paiknemises Eesti NSV-s. [Changes in the Distribution of Industry in the Estonian S. S. R.] *Nõukogude Eesti majandus 1940—1960* (Tallinn, 1960), p. 138.

¹⁵ *Ibid.*, p. 139.

¹⁶ L. Tulp: Eesti kaubavahetuslikud seosed kapitalismi ja sotsialismi tingimustes. [Trade Relations of Estonia in the Conditions of Capitalism and Socialism]. *Nõukogude Eesti majandus 1940—1960* (Tallinn, 1960), p. 108.

trial centre has been enriched with new industrial enterprises, in the first place by those belonging to the machine-building, metal-processing, chemical and building-materials industries. On the other hand, according to the principle of a more uniform distribution of socialist industry, one can at present observe the development of industry outside Tallinn. The dense radial network of roads and railways, which prompted an exceedingly high concentration of industrial enterprises in Tallinn under capitalist conditions, contributes under Soviet power to a more uniform distribution of the productive forces within the entire economic region. By now a number of new industrial enterprises have arisen outside the confines of Tallinn (at Maardu, Risti etc.) In the course of the current Seven-Year Plan period this tendency will become more pronounced with the creation of new industrial satellite towns of Tallinn, such as Aruküla, Raasiku, Tapa, etc. In addition, district centres situated on the borderland of the economic region (such as Haapsalu, Paide, Rapla and Türi) have recently acquired new industrial enterprises.

As in the other parts of the Republic, dairy and meat farming dominate the agriculture of the economic region. However animal husbandry, poultry farming and the growing of vegetables play a greater role here than in the other parts of the Republic ¹⁷.

A certain growth of zonal features may be observed in the agriculture of Northern Estonia as one moves farther from Tallinn. In the immediate vicinity of Tallinn and its industrial satellites, agriculture is of the suburban type. Here the cultivation of vegetables in hot-houses and hot-beds as well as in the fields, potato growing, poultry farming and the raising of cattle for milk production prevails. As one moves farther from Tallinn, the role of grain and fodder crops increases, in the south-west (in the vicinity of Vigala) flax appears in plant-growing.

State deliveries of the collective and state farms of Northern Estonia in agricultural produce constitute 30% of the Republic's total and nearly as much of meat and milk. Taking into account the great percentage of the urban population (72%), this economic region cannot cover its own demands in agricultural products and thus imports part of its food-stuffs from other sections of the Republic.

The problems of the development of Northern Estonia are connected, on the one hand, with the more effective use of the experience of the local population gained in the process of production in the machine-building and textile industries; on the other hand,

¹⁷ V. Teitelbaum: Loomakasvatussaaduste tootmise paiknemine ning tasuvus Eesti NSV kolhoosides. Zusammenfassung: Anlegung in der Erzeugung der tierischen Produkten und ihre Rentabilität in den Kolchosen der Estnischen Sowjetrepublik. *Eesti Põllumajanduse Akadeemia Teaduslike Tööde Kogumik*, Vol. 10 (Tartu, 1959), pp. 186—187.

problems requiring solution are connected with the more rational utilization of the local resources (such as phosphorite, timber, mineral building materials) and the raising of the production capacity of agriculture (land amelioration, the creation of a self-sufficient fodder-base, the elaboration of the optimum structure of plant-growing). Problems of the regulation of the water-supply, particularly within the area of Tallinn itself, also require solution.

Northern Estonia participates in the regional division of labour with the products of its manufacturing industry, such as machines, apparatus, metal goods, building materials (bricks and prefabricated construction blocks), textiles and readymade clothing, fertilizers, pharmaceutical products, furniture, and paper. On the other hand, it is the largest consumer in the Republic of electric power, gas, agricultural products and imported metal, cotton, wool, coal, etc. The economic region under discussion makes the greatest contribution in the Republic to the all-Union national economy, and participates in international trade chiefly with various electrical and radio-engineering appliances, paper and textile goods.

2. North-Eastern Estonia

North-Eastern Estonia is primarily an industrial region. This territorial complex of production is based on the oil-shale, chemical and power industries. As in Northern Estonia, agriculture occupies a subordinate place here, being only of local importance. The economic region of North-Eastern Estonia comprises the urban district of Kohtla-Järve, the towns of Narva and Sillamäe, and the Rakvere administrative district. This economic region includes one-seventh of the Republic's territory with over one-sixth of the Republic's population. One-fourth of the industrial workers of the Republic have been concentrated here, and it turns out one-fifth of the Republic's industrial output.

Compared with the economic region of Northern Estonia, North-Eastern Estonia is a young economic region. The development of its basic industry started during the First World War. In 1916, the first trainload of oil-shale was sent from a mine situated near the railway-station of Kohtla to the gas-works of the Polytechnic Institute of Petrograd for testing. The experiments carried out there yielded good results and proved the suitability of oil-shale for use as a fuel and raw material for the chemical industry.

"The Government Oil Shale Plant" founded with state capital in 1919 was the first industrial producer of oil-shale in the early years of the existence of bourgeois Estonia. Besides this enterprise, there arose several joint-stock companies founded with foreign capital which in 1939 produced two-thirds of the oil-shale mined and a like amount of the shale oil processed in Estonia. During the

whole existence of the bourgeois regime the total output of oil-shale was 10.8 million tons.¹⁸

The development of the oil-shale and chemical industries and power economy into a many-sided production complex belongs to the period of Soviet power. In 1963 the output of oil-shale amounted to 12.9 million tons¹⁹ and will go up to 14.5 million tons per year at the end of the Seven-Year Plan period.²⁰ Behind these figures are the mines and quarries as well as the oil-plants that have been restored in the course of the restoration of the national economy of the Estonian S. S. R. or which have been newly founded in the period of socialist reconstruction. Behind these figures are the first-in-the-world oil-shale gas-works and the high-capacity Baltic Thermal Power-station, the electric power-stations at Kohtla-Järve and Ahtme, and many other industrial enterprises.

Nearly all the other aspects of the economic life of North-Eastern Estonia are associated with meeting the requirements of oil-shale chemistry and power economy. The needs of these basic branches of production also determine the development of the metal industry, the production of building materials, the construction industry and even the textile industry and agriculture, and unite all the production elements vertically as well as horizontally into an integral whole. In this process, particularly in the course of the realization of the Seven-Year Plan, the industrial complex of Narva²¹ will be bound up with the oil-shale basin — the core of North-Eastern Estonia — into one territorial production complex. The same applies to the centres lying on the periphery of this economic region (Aseri, Kunda, Rakvere, etc.)

The industrial development of North-Eastern Estonia has brought about great changes in the geographical distribution of its population. While the population of the entire Republic in the period 1934—1959 increased by 13%, the increase in North-Eastern Estonia was 44%. This rise was in the first place due to the influx of manpower from the other parts of the Republic as well as from other fraternal Republics. The increase in the population has been accompanied by another major change — a marked rise in the size of the urban population. In 1959, 65.7% of the population of this economic region lived in towns. The concentration of the

¹⁸ A. Veimer: Eesti NSV sotsialistlik industrialiseerimine [Socialist Industrialization of the Estonian S. S. R.] (Tallinn, 1958), p. 145.

¹⁹ Statistika Keskvalitsuse ametlik teadaanne [Official Statement of the Central Board of Statistics], 2. II 1964.

²⁰ А. Веймер: Комплексное развитие и специализация промышленности Эстонского экономического административного района (Tallinn, 1961), p. 135.

²¹ It must be pointed out that Narva as an industrial centre is older than Tallinn, but industrial Narva, which in its development was based on the raw materials imported from overseas countries and depended on remote markets, did not become a factor leading to the formation of the economic region.

population in towns is directly connected with the rise of new urban settlements round the oil-shale mines and quarries and the enterprises of the oil-shale industry.

Compared with Northern Estonia, North-Eastern Estonia lacks the concentration of industrial production at one place, and the enterprises of production (mines, oil factories, electric stations, plants producing building materials, etc.) have been distributed all over the region. The creation of the urban district of Kohtla-Järve and the joining of the previous towns of Jõhvi and Ahtme into the town of Kohtla-Järve contribute somewhat to the apparent concentration. In actual fact, the individual industrial settlements remain isolated from one another and approach one another only as new enterprises are created. Thus, while in the Seven-Year Plan period and in the future the original concentration of industry in Northern Estonia will give way to deconcentration, the industrial enterprises of North-Eastern Estonia and the urban settlements around them, which originally were sparsely scattered over the region, are now as it were drawing nearer to one another through the foundation of new industrial enterprises.

Since North-Eastern Estonia is a young economic region, there are still instances of unused reserves and disproportions (e.g. fluctuation of labour in the town of Narva, unused reserves of female labour in the oil-shale basin, insufficient development of light industry at Kohtla-Järve and heavy industry in Narva, etc.). The efforts of the leading organs of the national economy are aimed at drawing in the unused reserves and the eliminating the disproportions.

The agriculture of North-Eastern Estonia is essentially of the suburban type, particularly in the vicinity of the industrial centres. Alongside the production of dairy produce, the growing of vegetables and potatoes occupies an important position in local agriculture.²² The agriculture of this region is characterized by the great role of the state farms, especially in the Kohtla-Järve district. The present level of agriculture does not meet the needs of the local population for food-products, or the demand of industry for agricultural raw materials. North-Eastern Estonia gives the State only 13% of the State deliveries of meat and nearly the same amount of milk. The development of agriculture is impeded by the scarcity of agricultural land (about one-eighth of the area of the agricultural land in the Republic), an abundance of land affected by excessive moisture, thin soils, etc. The limited volume of agricultural production makes it necessary to import additional food-stuffs from other parts of the Republic.

²² V. Teitelbaum: Taimekasvatussaaduste tootmise intensiivsus ja paiknemine Eesti NSV-s. Zusammenfassung: Die Intensität und räumliche Gliederung der Feldwirtschaft in der Estnischen SSR. *Eesti Põllumajanduse Akadeemia Teaduslike Tööde kogumik*, Vol. 15 (Tartu, 1960), pp. 3—35.

The normal development of economic relations between the economic region under consideration and the other regions is hindered by the network of roads which in the course of history have developed one-sidedly. North-Eastern Estonia has a well developed network of roads leading from the west to the east, but a very insufficient network of roads passing from the north to the south, and particularly of roads going from the north-east to the south-west. The construction of trunk roads leading from the north-east to the south-west is a necessary pre-condition for the facilitation of the transport of agricultural produce and for the establishment of reasonable economic relations between North-Eastern Estonia and the central and the south-eastern parts of the Republic. This problem should attract the attention of the leading organisations responsible for transport in the Republic. The construction of roads leading from the north-east to the south-west would help to strengthen the internal economic links of North-Eastern Estonia.

The problems of the further development of North-Eastern Estonia are connected with the more effective utilization of the rich natural resources (oil-shale, Cambrian clay, phosphorite, etc.) in the oil-shale chemistry, the power economy and the industry of building materials. These problems will become particularly urgent when the oil-shale basin need no longer provide gas for Leningrad and will confine itself basically to the processing of oil-shale on the spot. The problems of development of the agriculture of this region are linked with the creation of a self-sufficient food basis for the supply of the local industrial towns and the health-resort settlements. The attainment of this aim makes it necessary to expand the area under crops and to make more rational use of it in agricultural production of the sub-urban type.

In the geographical specialization of economy North-Eastern Estonia chiefly has to supply other parts of the Republic with electric energy, fuel, products of the chemical industry, building materials (cement, lime) and textiles. While Northern Estonia participates in the foreign trade of the Soviet Union with its instruments and food products, the economic tasks of North-Eastern Estonia are confined to the supply of electric energy, oil-shale and textiles to other fraternal Republics.²³

3. South-Eastern Estonia

From the point of view of geographical specialization, South-Eastern Estonia is primarily an agricultural region with a rapidly developing manufacturing industry. This economic region includes

²³ L. Tulp: Eesti NSV majanduslikud sidemed teiste liiduvabariikidega. Zusammenfassung: Die wirtschaftlichen Wechselbeziehungen zwischen der Estnischen SSR und den anderen Republiken der Sowjetunion. *Eesti Geograafia Seltsi Aastaraamat 1959*. (Tallinn, 1960), pp. 211—212.

the town of Tartu and the administrative districts of Tartu, Jõgeva, Põlva, Võru and Valga. South-Eastern Estonia accounts for one-third of the territory of the Republic with a population exceeding one-fourth of the population of the Republic.

Compared with the economic regions dealt with above, the development of South-Eastern Estonia has proceeded along different lines. The decisive force in the formation of economic regions is industry, but there is no large agglomeration of industrial enterprises in South-Eastern Estonia as there is in the above-mentioned economic regions in the form of Tallinn and Kohtla-Järve (Tartu accounts for less than 7% of the total industrial output of the Republic). This is why the process of the formation of this economic region has been slower and less intense, why the branches of production are so slightly connected with one another, and why the central links in the distribution of the productive forces in South-Eastern Estonia are not so readily and distinctly recognizable. But if we start from industry as the decisive factor determining the distribution of the productive forces, take into account the uniformity of the problems of development of agriculture, consider the specific features of the natural conditions and of the geographical position, as well as bear in mind the administrative and territorial division as a factor in the rise and development of economic relations, we shall be able to detect the following peculiarities in the formation of South-Eastern Estonia as an economic region.

As V. I. Lenin pointed out, the differentiation of economic regions is characteristic of the development of capitalism.²⁴ The economic differentiation of South-Eastern Estonia also manifested itself distinctly in connection with the development of capitalist relations. At the end of the nineteenth century present-day South-Eastern Estonia was the north-eastern part of the province of Livonia. Until the end of the fourth quarter of the previous century this part of the country remained an agricultural region which in many points of its specialization differed greatly from the other parts of Estonia.²⁵ The pre-conditions for the development of industry were created when South-Eastern Estonia was in 1876 connected up with the Russian railway network (which facilitated the transport of raw materials — iron and coal) and when, as a result of the development of capitalism, part of the labour became redundant in agriculture. In this connection the local resources of raw materials (such as timber, agricultural produce, fish, etc.) were drawn into economic circulation. The first enterprises of the metal industry came into being in Tartu above all as a railway junction with a favourable location. Enterprises of the food and wood in-

²⁴ В. И. Ленин: Сочинения, Vol. III (Moscow, 1941), p. 17.

²⁵ С. Ныммик: Юго-Восток Эстонской ССР (экономико-географический очерк) (Leningrad, 1956), p. 8.

industries were mainly founded near the sources of raw materials scattered all over the region as well as situated on the trunk roads. Apart from being a railway junction, Tartu was the administrative centre of the district and was located at a considerable distance from Pskov, Riga, Tallinn and Narva. Being the only larger town in this part of the country, Tartu thus had good pre-conditions for becoming the economic centre of the whole of South-Eastern Estonia.

In spite of the limited development of industry here, South-Eastern Estonia remained under the bourgeois regime primarily an agricultural region. On account of the limited amount of economic communication with the Soviet Union, particularly across the border in the south-east, and with Latvia across the border in the south, this region of the bourgeois Republic remained in the position of a mere frontier sac. The limited local needs were the chief stimuli of the development of economic life here. Machine-building together with the metal industry had gradually acquired a prominent position in Tartu. These industries (with the exception of the telephone factory) turned out simple farm machinery and farm implements to meet the needs of the agriculture of Estonia. In 1937 next after these industries came the wood industry, then followed the textile and the sewing industry and others.²⁶ In the process of the development of industry, the economic links of Tartu with its hinterland became steadily closer.

The establishment of Soviet power in Estonia denoted the beginning of a new stage in the development of South-Eastern Estonia. From the aspect of economic geography the position of South-Eastern Estonia changed considerably after the admission of the Estonian S. S. R. to the Soviet Union. Being located on the chief communication line connecting the Republic with the central region of the Soviet Union, ample opportunities opened up before this part of the country to transport various kinds of raw materials easily from other fraternal Republics. Taking into account the needs of the national economy of the Soviet Union and the existence of local qualified cadres, South-Eastern Estonia became a seat of the instrument-making industry turning out products for the all-Union market. At the same time the industries processing the local raw materials (the building-materials industry, the wood and food industries) were reconstructed and expanded. By making use of hitherto unused opportunities, the foundation was laid for the complex development of the economy of South-Eastern Estonia. This was facilitated by a well-developed network of communications.

Today South-Eastern Estonia resembles Northern Estonia in the

²⁶ 1937. a. majandusloenduse andmed, vihik I. Tööstus. [Data on the economic census of 1937, Vol. I. Industry.] (Tallinn, 1939), Table 3.

structure of its industry, though the role of industry in the structure of the economy is considerably smaller. Only about one-seventh of the Republic's industrial workers have been concentrated in this region and it turns out about the same proportion of the industrial output of the Republic. Although under the Soviet regime a great number of new industrial enterprises have been founded in the other towns of South-Eastern Estonia (at Võru, Valga, Põlva, Põltsamaa; etc.), the chief industrial enterprises of the economic region under discussion have been concentrated in Tartu. Tartu is also an organisational centre for the electric power economy of the region. Tartu has become the seat of several trade organisations of distribution (trade bases, a grain elevator, etc.) and many planning institutions whose sphere of activity embraces the territory of South-Eastern Estonia within the limits mentioned above.²⁷ The activities of all these institutions have contributed to the development of the economic links which are concentrated in the town of Tartu and embrace the whole territory of South-Eastern Estonia.

The majority of the population of South-Eastern Estonia are employed in agriculture. Over three-fifths of its population live in rural districts. The development of the agriculture of this region proceeds in economical and natural conditions differing from those in the other parts of the Republic. Of these conditions one must specially point out the peculiar proportion of the fields, meadows and pastures. The all-Republican ratio of arable land to grassland is 2:3. But in South-Eastern Estonia arable land in places accounts for 60—70% of agricultural land. There also exist in this region fewer opportunities of increasing the area of grasslands by means of land amelioration than elsewhere. As a result of such a structure of agricultural land the satisfaction of the needs of cattle-raising must proceed at the expense of arable land. The analysis of the structure of the sown area shows that in South-Eastern Estonia a smaller amount of land is under fodder crops than in the other parts of the Republic. 34—42% of the area under crops is occupied by low-yielding field-hay. Such a pattern of the sown area with a specific ratio of different kinds of agricultural land does not ensure a self-sufficient fodder base for cattle-raising.²⁸ Consequently the structures of the basic branches of agriculture have not been co-ordinated and this is one of the chief objective reasons why the agriculture of South-Eastern Estonia (with the exception of the districts lying round Tartu) lags behind the level of agriculture in the advanced parts of the Republic.

Flax-growing is an essential characteristic of the specialization of agriculture in this region which distinguishes it from the other

²⁷ С. Ныммик: *op. cit.* [see footnote 10 above], pp. 63—64.

²⁸ V. Teitelbaum: *op. cit.* [see footnote 22 above], p. 16.

economic regions of the Republic. South-Eastern Estonia occupies first place in the Republic in flax-growing since it includes approximately four-fifths of the entire area under flax in the Republic. Alongside the grain and the fodder crops, this branch of plant-growing calls for particular attention. It is evident from the above that the establishment of the optimum structure of the sown area is one of the basic conditions of raising the level of agriculture in South-Eastern Estonia.

The agriculture of South-Eastern Estonia is developing under very complicated natural conditions.²⁹ The creation of a stable fodder base for cattle-raising in this region is made difficult by a number of circumstances — the scattering of the plots of land under cultivation all over the countryside due to its highly hilly relief, the obstacles that the topography presents to the mechanization of agriculture, the erosion and excessive acidity of soils, and the unfavourable hydrographical conditions due to the high water-level of Lake Peipsi. All these factors make it necessary to find a specific approach to the problems of agricultural development.

The problems of the further development of the south-eastern economic region are connected with the utilization of local skilled labour in instrument-making and in other branches of industry. The basic problems of agricultural development are the enlargement of the plots of land under cultivation, the procurement of farm machinery and farm implements adjusted to the hilly relief of the land, the prevention of erosion, fertilization with lime, the introduction of high-yield fodder crops and hence the ensuring of a stable self-sufficient fodder base for cattle-raising. It will be seen from the above that South-Eastern Estonia has its own specific features of production and problems of development which differ from those of the other parts of the Republic.

As to the specialization of economy within the Republic, South-Eastern Estonia supplies the industrial regions of the Republic with the necessary food-stuffs and agricultural produce. It gives over a third of the State deliveries of meat and about the same amount of milk. On the other hand, this region, like many other parts of the Republic, depends on North-Eastern Estonia for electric power. The economic region participates in the all-Union national economy with its production of apparatus, certain building materials and processed food-stuffs (dairy products for Leningrad, canned food, etc.).

²⁹ С. Ныммик: К вопросу экономико-географической характеристики природы Юго-Востока Эстонской ССР. *Eesti Geograafia Seltsi Aastaraamat 1957* (Tallinn, 1957), p. 168.

4. South-Western Estonia

Like South-Eastern Estonia, South-Western Estonia is primarily an agricultural region with a rapidly developing manufacturing industry, the urban population accounting for 45% of the total. The region embraces the town of Pärnu, the administrative districts of Pärnu and Viljandi. This constitutes over a fifth of the territory of the Republic with a population of approximately a seventh of the total population.

In the economic regions dealt with above there is a central link in the form of an industrial centre (e.g. Tallinn in Northern Estonia, Tartu in South-Eastern Estonia) or in the form of an agglomeration of industrial settlements (e.g. Kohtla-Järve in North-Eastern Estonia). Such an industrial centre is the junction of the economic connections with the surrounding territory; it exercises its influence on the development of the productive forces of the environs and unites the different parts of the economic region into an integral whole. There is no such distinct central link in South-Western Estonia. The different parts of the economic region are comparatively slightly connected with one another. In developing this region it is not the economic links with the centre that we take for a criterion but rather the specialization of the economy (the mutual inter-relationship of the different branches of the economy) and the specific problems of economic development in this part of the Republic. The development of industry, which is normally the key factor in the formation of economic regions, proceeds in South-Western Estonia primarily on the basis of various local natural resources (such as peat, timber, fish) as well as on the basis of agricultural produce (flax, milk, meat, hides). Here the relationship between agriculture and industry is closer than in the other parts of the Republic. The different parts of this territory are also linked by common problems of transport.

The industrial development of South-Western Estonia started rather early, but for a number of reasons this development has not led to the overwhelming preponderance of industry. Saw-mills could be met with in the environs of Pärnu already in the middle of the eighteenth century; sawn timber was exported. The processing of timber and its export were directly connected with the rise of ship-building on the coast: on the one hand wood provided raw material for ship-building, on the other hand sawn timber was exported on the vessels built there. At the beginning of the nineteenth century three glass-factories were founded in the Pärnu district (one at Vändra and two at Lelle).³⁰ In the first half and in the middle of the same century, in the course of the development of

³⁰ O. K a r m a: Tööstuslikult revolutsioonilt sotsialistlikule revolutsioonile Eestis [From Industrial Revolution to Socialist Revolution in Estonia] (Tallinn, 1963), pp. 39—40.

the capitalist manufacturing industry, two out of the four cloth-factories of Estonia were founded in the south-western region (one at Sindi in 1835 and one at Voltveti in 1859). In the second half of the nineteenth century South-Western Estonia ranked first among the other parts of Estonia in the brisk development of the timber industry, which remained a major branch of the local industry, till the end of the century. The role of the timber-processing industry increased still further when the largest cellulose works of tsarist Russia, "Waldhof Ltd." of Pärnu, was founded at the turn of the century.

The pre-conditions for the development of the timber, cellulose and pulp industries in South-Western Estonia were highly favourable: ample raw material in the form of timber, cheap labour, and advantageous transport conditions. The port of Pärnu and the Pärnu river with its tributaries, the joining of Pärnu by means of a railway line to the all-Russian railway network facilitated the transport of timber. As a result Pärnu ranked first among the towns of Estonia in the export of sawn timber before the First World War.

In the years 1909—1913, which marked a rise of industrial activity in Estonia, flax spinning and knitting mills were founded by the Estonian bourgeoisie at Pärnu, Viljandi and Mõisaküla, and flax mills were erected at Abja, Tori and Saarde. The development of the flax industry was also connected with Pärnu as a port via which the flax exports passed. The difficulties of marketing flax on foreign markets and the appearance of redundant labour on account of the development of capitalist relations in agriculture created favourable pre-conditions for the development of the flax industry in this flax-growing region.

In the period of bourgeois Estonia the chief emphasis in the development of the natural economy was laid on agriculture, which contributed to the advancement of the dairy industry; at the same time the flax industry was in difficulties. Owing to the destruction of "Waldhof Ltd." during the First World War South-Western Estonia lost its importance as a producer of pulp and cellulose. In spite of this fact the timber industry retained its prominent position. Before the world economic crisis of 1929—33, eighty saw-mills operated in the Pärnu district, twelve of them in the town of Pärnu alone. The development of the timber industry was greatly helped by the construction of the new railway lines of Lelle-Papi-niidu and Riisselja-Ainaži. To meet the needs of the municipal economy and those of industry, peat enterprises were founded at Lavassaare and Tootsi. The health-resort of Pärnu (founded in the previous century) made big strides. The development of the overwhelming majority of industrial enterprises was chiefly connected with the port of Pärnu and this was the reason why they were founded within the limits of the urban district.

In the period preceding the Soviet regime, industry was feebly developed in the eastern part of South-Western Estonia, but this part of the region excelled through its well-developed agriculture. At the end of the last century a prominent position in agriculture was occupied by flax-growing, during the bourgeois period, however, by dairy farming.

With the establishment of Soviet power South-Western Estonia started on the road of industrialization. Alongside the reconstruction and extensive expansion of the old branches of industry — the peat, timber, textile and dairy industries — several new branches of industry were founded in the region, such as machine-building (at Pärnu, Mõisaküla and Viljandi), the knitted goods industry (at Pärnu), the leather and foot-wear industries (at Pärnu and Viljandi) the furniture industry (at Viljandi and Pärnu), the fish-processing industry (at Pärnu), the industry of canned fruit and vegetables (at Viljandi), etc.

It will be evident from the above that the industry of South-Western Estonia is chiefly based on various local raw materials. Flax growing and processing occupy a special position here because they form an essential link between agriculture and industry. All the flax spinning and knitting mills of the Republic and a large number of its flax-mills have been concentrated in this region. The problem of providing the flax industry with adequate supplies of raw materials is an important task of the local economy. Flax-growing should, therefore, not be expanded in Central Estonia where there are no flax-mills, but in South-Western and South-Eastern Estonia where flax-mills already exist and where their total potential capacity has not yet been fully utilized. Co-operation with the Latvian S. S. R. may provide these enterprises with more raw material. This would entail certain changes in the structure of agriculture, namely an expansion of the area sown to flax.

More changes in the structure of plant-growing may be envisaged in South-Western Estonia. This region is that part of the Republic where in recent years the role of fodder-crops, including perennial field-hay, was greater than in any other part of the Republic. According to the data for 1959 the area under perennial field-hay accounted for 40—50% of the total sown area of the collective and state farms.³¹ At the same time, with regard to the level of the development of dairy farming, South-Western Estonia was one of the most backward regions of the Republic.³² In the interests of ensuring a firm fodder basis for cattle-raising, the structure of the agricultural crops cultivated in the region should be reorganized in favour of high-yielding crops (maize, fodder beans, etc.).

³¹ V. Teitelbaum, *op. cit.* [see footnote 22 above], p. 16.

³² V. Teitelbaum, *op. cit.* [see footnote 17 above], p. 167.

South-Western Estonia is serviced by the narrow-gauge railway line of Pärnu-Lelle-Viljandi-Mõisaküla-Pärnu, part of which leading from Riisselja to Ainaži extends towards the south-west up to the boundary of the Republic. This narrow-gauge railway system represents that part of the railway network in the Republic which has unfortunately no direct connecting link with the broad-gauge railway system. The lack of a direct railway service between South-Western and South-Eastern Estonia makes itself particularly felt. The unification of all the railways of the Republic to one and the same standard width is an essential condition for the development of South-Western Estonia in general and that of railway transport in particular. The network of highways also needs to be expanded and developed in accordance with the future system of economic links.

Thus the basic problems of development of the economy of South-West Estonia are primarily connected with agriculture and forestry and the industries based on them.

Alongside the general and common features and problems of development, one can also observe essential intra-regional differences in South-Western Estonia.

The western part of the region gravitates economically towards Pärnu. The branches of the national economy characterizing this part of the economic region, such as fishing and processing of fish, management of ports and health-resorts, have also been concentrated in Pärnu. To them may be added the machine-building, timber, wood, textile and peat industries, as well as other branches of industry. Enterprises of these industries are situated partly in Pärnu, partly outside of it (at Sindi, Tootsi, Lavassaare).

Problems of amelioration occupy a prominent position in the development of South-Western Estonia. On their solution depend both agriculture, forestry and transport. The Pärnu Lowlands are characterized by an abundance of forests, swamps and boggy lands as well as by a scarcity of agricultural land. The further expansion of agricultural land requires the carrying out of land-reclamation measures on an extensive scale. The agriculture in the close vicinity of Pärnu is of a suburban type and in the first place caters for the population of Pärnu, which has grown by 70% as compared with the population of the city in 1939. In the maritime region south of Pärnu truck-farming has a prominent place. In the remoter parts of the region, agriculture is oriented towards dairy-farming and flax-growing. The region under discussion is bounded on the east and on the north by a belt of extensive swamps and bogs which separate this part of the region from its eastern counterpart in the form of a natural boundary.

The eastern part of South-Western Estonia chiefly covers the Sakala Uplands and the western part of the Basin of Lake Võrtsjärv which belong to the administrative district of Viljandi. The

economic centre of this part of the economic region is the town of Viljandi. This part of South-Western Estonia is primarily an old agricultural region which today is characterized by dairy-farming and intensive pig-raising. Natural conditions for the development of agriculture are here favourable. While amelioration plays a highly essential role in the vicinity of Pärnu, the area under consideration is characterized by sloping soils with a deep arable layer. Only the flat bottoms of the primeval valleys, besides the parts stretching towards the depression of Lake Võrtsjärv and those extending to the Pärnu Lowlands, need to be drained. Here the forests are less numerous.

The development of industry started here already in the second half of the eighteenth century with the processing of agricultural produce.³³ Up to the present the basic branches of industry are the food, milk, meat and canning industries. To these must be added the historical flax industry and the industries that have been founded under Soviet power: the knitwear, sewing, leather, footwear, fur and other industries. The majority of the industrial enterprises of this economic subregion are situated in the town of Viljandi. The radial network of roads converging on Viljandi promotes the consolidation of economic links between this town and the other settlements on the territory under discussion (Suure-Jaani, Võhma, Mustla, etc.). The system of power lines starting at Viljandi also contributes to the strengthening of mutual links.

It will be seen from the above that alongside the problems of development embracing South-Western Estonia as a whole, various parts of this economic region have substantial differences in specialization as well as in problems of development. Division into two parts is further promoted by the territorial organization of economic links and the natural conditions. These circumstances justify us in distinguishing two subdivisions — the subregions of Pärnu and Viljandi — within the limits of South-Western Estonia.

Like South-Eastern Estonia, South-Western Estonia is the supplier of the industrial regions of the Republic with food-stuffs (dairy products, meat, fish, and canned fish, fruit and vegetables) and sawn timber, as well as textiles and woollen fabrics. Apart from these, it produces dairy installations and peat briquettes. South-Western Estonia participates in the all-Union specialization of economy with its production of canned fish, textiles and dairy products.

5. The West-Estonian Archipelago

In addition to the mainland, the territory of the Estonian S. S. R. includes a great number of islands, which form a distinctive part of the Republic. The majority of them, including the largest

³³ Eesti NSV ajalugu [History of the Estonian S. S. R.] (Tallinn, 1957), p. 141.

islands, are situated near the western coast of the Republic, constituting the West-Estonian Archipelago.

The largest of these islands, Saaremaa, along with Muhu Is. and a number of other off-shore islands, including those of Abruka and Vilsandi, make up the administrative district of Kingissepa. The next island in size, Hiiumaa; together with a number of small off-shore islands, constitute the administrative district of Hiiumaa.

The islands of Estonia in the administrative districts of Kingissepa and Hiiumaa cover nearly one-tenth of the territory of the Republic and have a population which makes up approximately one-twentieth of the total population of the Republic. From the economic aspect, the islands represent an agricultural part of the Republic where at the same time fishing plays a prominent role; the urban population is small, constituting slightly over 23% of the total number of islanders. The islands supply less than 2% of the industrial output of the Republic. The basic branch of the large-scale industry here is the fishing industry.³⁴

The economic life of these islands has a number of peculiarities resulting from their historical development.

Throughout the centuries the inhabitants of the coastal areas of the islands have been engaged in fishing and navigation, those living in the interior have cultivated land of low fertility. At the turn of the nineteenth and twentieth centuries the other parts of Estonia had made big strides on the road of capitalism. At the same time the economy of the western islands had largely retained the characteristics of a natural economy, with only slight elements of a commodity economy. The town of Kuressaare (now Kingissepa) and the settlement of Kärkla were to some extent exceptions. Before the First World War there was a leather factory at Kuressaare employing about 300 workers, while there was a cloth factory with 600 workers at Kärkla. The economic life of Kuressaare was somewhat enlivened by the health-resort.

During the bourgeois period what industry there was in the island declined. Compared with 1913, in 1939 twice as few workers were employed in the large-scale industry of Hiiumaa and three times fewer workers were engaged on the territory of the Kingissepa district. Hence the lag of the islands behind the other parts of the Republic increased still further.³⁵ Fishing brought little income owing to the difficulties connected with the realization of the catch. The agriculture of the islands could not give employment to the entire labour force; industry however, played a very slight role. Due to this fact, the majority of able-bodied menfolk went to sea to earn some extra money to supplement the bare income of an islander; unemployed womenfolk went to the mainland to serve

³⁴ V. Tarmisto, *op. cit.* [see footnote 14 above], p. 152.

³⁵ *Ibid.*, p. 141.

as farm-maids. The share of the islands in the capitalist commodity economy was exceedingly small.

After the establishment of Soviet power there began a sharp rise in the economic life of the islands. The Soviet government laid a firm foundation for the fishing economy. The creation of a stable network of mechanized reception centres along the coast and the foundation of the fish-processing industry ensured the fishermen facilities for marketing their catches. The economy was placed on socialist principles by the setting up of collective fisheries and by equipping them with up-to-date fishing-gear. In this way the State stimulated the local economy by furnishing both scientific management and technical equipment.

But alongside the problems that have been solved in the economic life of the islands one encounters problems that still require to be solved. Insularity requires a different approach to the problems of the economic life of the region. Above all one has to bear in mind the insular position of the region and the natural conditions prevailing there as well as the experience that the local population has gained in production.

The insular geographical position is a major factor in the development of the economy. It accounts for larger allocations to the communications and the maintenance of ports, etc. The islands are serviced from the mainland by sea. In this connection one has to take into account the existing freighters and a certain amount of isolation in the winter season. The formation and the break-up of the ice periodically interrupt navigation. The seasonal character and the difficulties of transport in general compel the transport bodies to organize the whole economic life of the islands so that as little transport is needed as possible. In solving the problems of future specialization these circumstances have to be considered. The perspective plans for the development of the economy of this region must be drawn up in favour of such branches of production as do not require much transport.

The natural environment also involves a number of peculiarities in which the islands differ from the continental part of the Republic and the consideration of which is obligatory in the planning and development of economic life. Some of these peculiarities promote, others impede the development of the economy. The mild climate of the islands and the resulting long vegetation period enable one to grow crops the cultivation of which is not so favourable in the continental part of the Republic. These are the less frost-resistant perennial crops. Taking this into account, the structure of agriculture in the islands includes not only the basic branches of agriculture, as cattle breeding, raising of crops and potatoes, but also the cultivation of hay seed. Alfalfa — an unpretentious variety of perennial field-hay — is cultivated here on thin, stony and gravelly calcareous soils. In the level of the development of agri-

culture, the islands lag behind the central and the northern part of the Republic. In spite of the great role attributed to cattle-breeding in the structure of agriculture, the productivity of dairy farming — one of the basic branches of agriculture — is low.³⁶

The sea that surrounds the islands offers additional opportunities for the development of the productive forces, particularly for sea transport and fishing and the utilization of other sea resources. Fishing and the fishing industry indeed play a major role in the local economy of the islands. In South-Western Estonia fishing and fish-processing are just one branch of production among the others; in the western islands it is the basic branch of the regional economy. It occupies first place in the structure of the industries of the Kingissepa district and second place in Hiiumaa.

But the development of industry cannot be confined to the processing of fish alone. The further development of industry in the islands must be based on a complete utilization of the local resources. Saaremaa is rich in dolomite and pure limestone. The mining of dolomite and its processing for the external covering of buildings and for various decorative building materials is already being carried out, but this branch of production should be developed on a much larger scale than at present.

In view of the experience already gained by the local population, instrument-making should be introduced into the islands, for instance the production of navigation appliances. With the aim of giving employment to female labour, it might be expedient to introduce the processing of wool, artistic knitting and carpet and rug marking for which the local population has enough experience. A basic pre-condition for the more extensive development of industry in the islands is their linking-up with the Republic's electric power system.

It will be seen from the above that the western islands of Estonia differ considerably in their specialization as well as in their problems of development from the other parts of the Republic. It is therefore necessary to regard this part of the Republic as a separate economic region.

The islands of Western Estonia participate in the inter-regional division of labour within the Republic chiefly by the production of canned fish, building materials and the cultivation of hay seed.

*

To sum up the foregoing, it is evident that the five parts of the Republic dealt with differ from one another in the specialization of production, the internal as well as the external economic links, the process of formation, and the problems of development.

³⁶ V. Teitelbaum, *op. cit.* [see footnote 17 above], pp. 162—167.

It is necessary to consider these objective differences in the perspective territorial organization of the national economy of the Republic. Only this will ensure the rational utilization of the natural and economic pre-conditions and of the labour resources in the interests of the growth of social labour productivity.

EESTI NSV MAJANDUSLIKUST RAJONEERIMISEST

S. Nõmmik

Resümee

Käesolevas artiklis põhjendatakse Eesti NSV majandusliku rajoneerimise vajadust. Lähtudes rahvamajanduse spetsialiseerimisest, majanduslike sidemete iseloomust ja arengu probleemidest kui majandusrajooni formeerumist määravatest faktoritest eraldatakse vabariigi territooriumil viis majandusrajooni: Põhja-Eesti, Kirde-Eesti, Kagu-Eesti, Edela-Eesti ja Eesti saared.

Neist on Põhja-Eesti ja Kirde-Eesti eelkõige tööstusrajoonid. Esimene neist on vana mitmekesise rasketööstuse ülekaaluga töötleva tööstuse rajoon, mille juhtiva tuumiku moodustab Tallinna tööstussõlm. Kirde-Eesti on noor majandusrajoon, mis kujunes sõjajärgsel perioodil. Selle majanduselu aluseks on kohalikule maavarale — põlevkivile toetuv põlevkivi-keemia-elektrienergeetika, ehitusmaterjalide ja tekstiilitööstus. Majandusrajooni südame moodustavad Kohtla-Järve ja Narva linn. Nii Põhja-Eesti kui ka Kirde-Eesti põllumajandusele on iseloomulikud linnalähise tüübi jooned (joogipiima tootmine, kõögivilja ja kartuli kasvamine, kasvuhoonemajandus, linnukasvatus).

Kagu-Eesti ja Edela-Eesti on eeskätt kiiresti areneva töötleva tööstusega põllumajanduslikud rajoonid, kuid kummagi majanduselule on iseloomulikud oma erinevused nii rahvamajanduse spetsialiseerimises, majanduslike sidemete iseloomus kui ka arenguprobleemides.

Kagu-Eestis nõuab vabariigi põllumajanduse põhiprobleem — kindla söödabaasi loomine karjamajandusele — erilist juurdeminekut, eelkõige taimekasvatuse struktuuri kooskõlastamist loomakasvatuse vajadustega. Tööstuse arengus on juhtival kohal masinaehitus ja metallitööstus juurdeveetaval toorainel. Kagu-Eesti majanduslikuks keskuseks on Tartu linn.

Edela-Eesti põllumajanduse põhiprobleemiks on põllumajandusliku maa juurdevõitmine maakuivenduse teel. Tööstus töötleb esmajoones kohalikku toorainet (turvas, mets, kala, lina). Edela-Eesti lääneosa majanduselule on asendist tingifuna iseloomulikud merega seotud majandusharud, nagu sadama- ja kuurordimajan-

dus, kalatööstus, mis on koondunud selle ala peamisse majanduslikku keskusesse — Pärnu. Edela-Eesti idaosa on põllumajanduslik piirkond. Selle keskus — Viljandi linnas on eelkõige põllumajanduslikku toorainet töötlev tööstus.

Saareline asend tingib Eesti saarte majanduses eripärase rütmi ja sunnib nende majanduselu arenguprobleemide lahendamisel esikohale seadma neid majandusharusid, mis vajavad väikest transpordimahtu. Sellest tuleneb ka vabariigi majanduslikul rajoneerimisel vajadus eraldada saared iseseisvaks ühikuks.

К ВОПРОСУ ОБ ЭКОНОМИЧЕСКОМ РАЙОНИРОВАНИИ ЭСТОНСКОЙ ССР

С. Ныммик

Резюме

В статье обосновывается необходимость внутриреспубликанского экономического районирования Эстонской ССР. Рассматривая специализацию народного хозяйства, характер экономических связей, а также проблемы развития как определяющие факторы районообразования, автор на территории республики выделяет пять объективно существующих экономических районов.

Из них Северная Эстония — старый, исторически сложившийся «столичный» экономический район республики. Ядром, определяющим территориальную организацию производительных сил этой части республики, является таллинский узел транспорта и разнообразной обрабатывающей промышленности. Главные ее отрасли — машиностроение и текстильная, а также отчасти химическая промышленность — развиваются на привозном сырье. Остальные же отрасли — промышленность стройматериалов, лесная, деревообделочная, целлюлозно-бумажная, пищевкусовая и прочие — базируются на местном сырье.

Северо-Восток является молодым экономическим районом, сформировавшимся преимущественно уже во время советской власти в Эстонии и на базе местного сырья — на горючих сланцах. Определяющие его производственную специализацию отрасли представляют связанные между собой сланцеводование, сланцехимию, электроэнергетику, а также промышленность стройматериалов. К ним следует причислить и исторически сложившуюся текстильную промышленность. Центр тяжести производственно-территориального комплекса Северо-Востока расположен на территории городов Кохтла-Ярве и Нарва и в их окрестности.

Сельское хозяйство двух вышерассмотренных промышленных экономических районов выделяется наиболее заметными признаками пригородного типа, преимущественно вокруг промышленных центров (производство свежего молока, овощей, птицеводство и пр.).

Юго-Восток и Юго-Запад оба являются сельскохозяйственными районами с развивающейся быстрыми темпами промышленностью. Однако каждый из них имеет свою специфику специализации народного хозяйства, внутренних и внешних экономических связей и проблем развития. Все это обусловлено различиями исторического развития, а также особенностями природной обстановки и географического положения.

Определяющее звено, в настоящее время имеющее большие перспективы в специализации промышленности Юго-Востока — машиностроение и металлообработка, — развивается на привозном сырье. Развитие сельского хозяйства затрудняет чрезмерная холмистость рельефа, обуславливающая раздробленность сельскохозяйственных угодий, эрозию почв и пр. В силу перешеечного географического положения между крупными эстонскими озерами — Выртсъярв и Чудское озеро — город Тарту уже в древности стал главным центром этой части Эстонии.

Промышленное развитие Юго-Запада республики идет главным образом на местном сырье (торф, лес, рыба, лен и пр.). Приморское положение западной части рассматриваемой территории придает экономической жизни района свой отпечаток в виде портового хозяйства и курортного дела. Главным городским центром этой части экономического района является промышленный и курортный город Пярну. Центром экономической жизни восточной части Юго-Запада является город Вильянди — типичный городской центр сельскохозяйственного хинтерланда, выделяющийся разнообразной обрабатывающей промышленностью на местном сырье.

Островное географическое положение определяет особый ритм экономической жизни западных островов и особый подход к решению проблем развития их народного хозяйства. Поэтому эстонские острова выделяются как особый экономический район республики.

ON THE WAYS OF DEVELOPMENT AND GENETIC CLASSIFICATION OF ESTONIAN URBAN SETTLEMENTS

T. Rea

In this article the author's earlier published works on the ways of development and the genetic classification of urban settlements of the Estonian S.S.R. have been summarized.¹ The article contains: (1) an interpretation of the genetic principle of classifying towns, (2) an application of this interpretation to the towns of pre-socialist Estonia, and (3) a characterization of the basic paths of development of the urban settlements of Soviet Estonia. As to the first problem the author has made his earlier standpoints more precise, taking into account the criticism published.² The second problem is dealt with in its earlier form, whereas some new material has been added to the third problem.

1.

Nearly twenty years have passed since N. Baranski propounded the idea of the genetic classification of towns in Soviet economic-geographical literature. He wrote, "We think that the classification

¹ T. Rea: Eesti NSV linnaliste asulate geneetilise klassifikatsioonist (sotsialismieelsel perioodil). Zusammenfassung: Zur genetischen Klassifikation der städtischen Siedlungen des bürgerlichen Estlands. *Tartu Riikliku Ülikooli Toimetised*, fasc. 88 (Tartu, 1960). — Т. Б. Реа: О понятии генетической классификации городов. Summary: On the Conception of the Genetic Classification of Towns. *Вопросы географии городов Прибалтики. Публикации Эстонского географического общества V* (Таллин, 1962). — Т. Б. Реа: О генетической классификации городских поселений Эстонской ССР до периода социализма. Автореферат диссертации на соискание ученой степени кандидата географических наук (Тарту, 1962).

² О. А. Константинов: Типология и классификация городских поселений в советской экономико-географической науке. *Материалы по географии населения*, вып. II (Ленинград, 1963), p. 26. — Э. В. Кнобельсдорф: Совещание экономико-географов союзных республик Прибалтики по вопросам географии городов. *Известия Всесоюзного географического общества*, 1961, No 1, p. 97. — А. А. Минц и О. Р. Назаревский: Региональное совещание экономико-географов Прибалтийских республик. *Известия Академии наук СССР, серия географическая*, 1961, No 1, p. 167.

[of towns] on the genetic principle is of outstanding scientific importance. This idea results from numerous examples in the history of the development of various other sciences which show that it is precisely genetic classifications which are of the greatest and most decisive importance, whereas all the others are of second-rate importance. The problem of classifying the types of coastal areas in physical geography may be adduced as a vivid and rather instructive example."³

Concrete attempts to classify the Soviet towns genetically have not hitherto confirmed the above-mentioned idea. Genetic classification has usually been identified with historico-geographical classification, i.e. with the grouping of towns according to the time and reasons of their original coming into existence. It is clear that a classification of this type cannot reflect sufficiently the differences in the contemporary economico-geographical composition of towns, since the subsequent development of originally similar towns has often followed different paths and has led to quite different results. Returning to the example given by N. Baranski we can see that the genetic classification of coastal areas does not mean that the coasts have been classified according to the original cause of their coming into existence, but they have been classified according to the complex of factors which moulded the contemporary coastal types. The same treatment may be extended to the towns.

As is generally known towns come into existence as a result of the territorial specialization of economy as centres of concentration of the non-agricultural population. Urban functions (industrial, transport and servicing) performed by an urban settlement in the territorial distribution of labour serve as the basis for the formation and development of an urban settlement. These functions have also been called town-forming factors (*градообразующие факторы*). The type of a town changes together with the changes in the town-forming factors (functions). The genetic classification cannot be limited to the determination of the original town-forming factor, but must also follow the changes in the town-forming factors and the formation of the contemporary functional type of the town. Hence, the genetic classification of towns must be not only historico-geographical, but at the same time a functional one.

Nowadays the functions of towns are generally considered to be one of the most important (if not the most important) foundations for classifying towns. Often there arise difficulties in finding objective criteria for the differentiation of functional types. Sometimes the towns of this or that country are taken as individual complexes and attempts are made to distinguish types by means

³ Н. Н. Баранский: Об экономико-географическом изучении городов. *Вопросы географии*, сб. 2, 1946, р. 32.

of purely statistical methods. In the author's opinion the functional classification can give the best results when it is approached genetically. After all, the coming into existence and the development of towns, including their differentiation into separate types, is not in the least a fortuitous phenomenon, but a regular historical process. But the best way of obtaining an objective scientific classification is not the mechanical classification of towns according to one or another formal feature, but the following of the objective process of the development of towns and the cognition of their historically established differences.

To apply the genetic principle means, generally speaking, to apply V. I. Lenin's well-known thesis: "...not to forget the underlying historical connection, to examine every question from the standpoint of how the given phenomenon arose in history and what principal stages this phenomenon passed through in its development, and, from the standpoint of its development, to examine what the given thing has become today".⁴ In other words, as applied to the classification of towns, this means: to analyse how in the course of history groups of towns of different age came into being and how later the functional transformation and differentiation of those groups took place. It is not important what the results of such an analysis are called. But it is important that only in this sense can the genetic classification justify the hopes that were given to it in the above-mentioned quotation from N. Baranski. Moreover, it would not be right to attribute universal significance to the method of classification described above and to exclude other possible ways of treatment.

2.

The objective characteristics of the material under examination led the author's attention particularly to the genetic principle in classifying towns. Analysing the functional structure and functional types of pre-socialist Estonian towns the author came to the conviction that at least in the conditions of Estonia it is impossible in classifying towns to obtain objective results (i.e. the differentiation of such types which correctly reflect the essential features of towns and their mutual relations) without taking into consideration their genesis. The Estonian towns have a long and diverse past. The contemporary state of affairs is the result of development during centuries and includes settlements of different functions and age. In order to orientate oneself correctly in:

⁴ V. I. Lenin. The State. Marx—Engels—Marxism (Moscow, 1947), p. 42.

the typological variety of contemporary towns it is necessary to analyse and explain the original causes and forms of this variety. Naturally during different periods in history there were different socio-political and economic conditions which caused the different functional specialization of towns. But at the same time every period left as a heritage to the following one an already established and differentiated system of settlements, and the further development of the latter depended to a great extent namely on the basis created earlier.

Already in the 12th—13th centuries the socio-economic development of the Estonian territory reached a stage where the separation of handicraft and trade from agriculture and the forming of urban settlements began. But more reliable information about the network of Estonian towns dates only from the end of the 13th century, i.e. the period following the German-Danish aggression. By that time a network of feudal towns had been formed on Estonian territory. To this network belonged Tallinn (Reval), Tartu (Dorpat), Pärnu (Pernau), Narva, Viljandi (Fellin), Rakvere (Wesenberg), Haapsalu (Hapsal), and Paide (Weissenstein). In the 13th—16th centuries in addition to the towns at least ten boroughs came into existence and two of them — Kuressaare (Arensburg, now Kingissepa) and Valga (Walk) — also acquired the rights of towns in the 16th century. But most of the medieval boroughs found no economic nutrient medium in the conditions of deepening serfdom. Having been left without any juridical privileges and military defensive buildings, they vanished gradually from the historical arena during the wars of the 17th—18th centuries.

The towns of the feudal period were functionally rather similar commercial, handicraft and military-administrative centres; no great qualitative differences appeared in their functional character. But their quantitative differentiation began already at an early date. Depending on the extent to which the towns on Estonian territory were able to join in the exchange of goods between East and West, the larger centres among them already differentiated quite early and they retained their position also during their further development in spite of repeated changes in the economic and political situation. Very early Tallinn left the other towns far behind as to the number of its inhabitants and its economic influence. Tartu was the second in size (except for a period of decline in the 17th—18th centuries).

In the 18th century the new towns of Võru (Werro) and Paldiski were founded. The former arose in the neighbourhood of the earlier medieval borough of Kirumpää. Võru was founded by the absolutist central authority as an administrative and commercial centre of the district and its further development coincided with that of the earlier towns of the same type. Paldiski came into

existence in connection with the naval base, though the latter was not finished. Among Estonian towns Paldiski has remained representative of a peculiar special type that cannot be fully connected with any basic genetic group.⁵

The disintegration of feudalism and the development of capitalist elements within the framework of the old order began on the territory of Estonia at the end of the 18th century. In connection with this great changes took place in the life of the towns on the Estonian territory. With the development of capitalism in the first decades of the 19th century the regeneration of the old feudal towns began. This followed different paths and led also to the qualitative differentiation of the towns in question. During the 19th century the former commercial and handicraft towns also became industrial centres (Tallinn, Narva), railway junctions (Valga), health resorts (Haapsalu, Kingissepa, Pärnu), and educational centres (Tartu). But in spite of such differentiation the old towns still retained very many features that were common to all of them.

Most of all the great commercial and industrial centres Tallinn and Narva, and to a lesser extent also Pärnu, were distinguished from the other towns. Tallinn, which had already become the largest commercial centre on Estonian territory and as a provincial capital was the most important administrative centre at the beginning of the 20th century, also attained first place as an industrial town. Narva was the first of the old towns to take the road of industrialization. The industrial profile of Narva was formed in outline already in the 1850's, when the Kreenholm Manufactory and Flax Mill were founded. At the same time Narva was the only one among the old towns where industry acquired a considerably dominant position. Thus, Narva in its development differentiated most from the other towns of the same age. This differentiation was favoured by the fact that, in contrast to all the other old towns, Narva, like Paldiski, was not the chief town of a district. Pärnu that had earlier been first and foremost a seaport of local importance for exporting flax, began with the completion of the largest cellulose mill in Russia in 1900, to resemble in type the towns with developed industry and trade, such as Tallinn and the other larger seaports of the Baltic area.

All the other old towns (except Paldiski) remained commercial and administrative centres of local importance (chief towns of districts⁶). They were characterized by comparatively varied functions (commercial, administrative, cultural, industrial, etc.), but generally by a poorly developed industry and by a fairly considerable internal trade.

⁵ For this reason Paldiski is not given in the Table on p. 96, showing the development of Estonian towns.

⁶ Est. *maakond*, Ger. *Kreis*, Russ. *uezd*.

From the year 1802 a special place among the other towns belonged to Tartu as a university town. Although the importance of Tartu as a cultural centre reached far beyond Estonian territory, its economic functions still remained the decisive factors for the development of the town.

The development of capitalism brought with it not only the functional differentiation of the old feudal towns, but also the rise of numerous new urban settlements. In the 19th century, mainly in its second half, a number of new commercial and industrial settlements came into being, and later they acquired officially the rights of urban settlements. Depending on the configuration of highways some of them arose in the neighbourhood of earlier medieval boroughs (Otepää, Keila, Tõrva near the earlier castle of Helme, Mustla near Tarvastu, Jõgeva near Laiuse), but essentially they were completely new settlements. The direct successors of the medieval boroughs of Lihula and Põltsamaa also acquired new economic content.

As to their origin and functions the urban settlements that came into existence during the period of capitalism were divided into four groups: (1) industrial, (2) transport, (3) commercial-handicraft, and (4) health resort settlements. In the case of some settlements various factors had an influence on their development and therefore they formed transitional stages between the above-mentioned types.

The industrial settlements arose near factories and their population consisted mainly of factory workers. The part played in their life by commercial and cultural functions was negligible. In some cases settlements of this type were created by a manufactory (e.g., Räpina, which arose in the neighbourhood of the Paper Manufactory founded in the 18th century). The first larger factory-industrial settlements arose during the second quarter of the 19th century around the Fulling Mills of Kärdlä and Sindi. At the end of the 19th century and at the beginning of the 20th century additional settlements arose around the Kunda Cement Works and the Paper Mills of Türi and Kohila. New industrial enterprises were mainly founded in places with favourable conditions for transport, where in some cases small commercial settlements had already begun to appear earlier (Kunda, Türi).

To the type of transport settlements belonged a small number of settlements that became railway junctions and the majority of whose population consisted of railwaymen and of workers at the railway workshops. Tapa was actually the only transport settlement of a pure type. In other transport settlements factories were founded beside railway enterprises at an early date (the Flax Mill at Mõisaküla, the Lime Kiln at Tamsalu), and this led to their becoming transitional types between industrial and transport settlements. The fact that their commercial func-

tions were of little importance brought them steadily closer to the type of the industrial settlement.

The social differentiation of the peasantry and the rise in the marketing of agricultural products served as a basis for the crystallization of numerous small commercial and handicraft centres out of the agricultural environment. Their population was formed by a variety of people who did not own land — farm-hands, artisans, merchants, etc. The first such settlements arose mainly in parish centres (e.g., Vändra, Otepää, Põlva, Rapla, Suure-Jaani), later near railway stations (e.g., Antsla, Jõgeva, Elva). The commercial and handicraft centre of Elva also served as a health resort.

Health resort settlements originated from various different economic profiles (fishing villages, such as Narva-Jõesuu, railway-station settlements, such as Elva and Aegviidu). They acquired new functions, on the one hand, owing to their natural advantages and, on the other hand, owing to their favourable connections with larger towns. The larger health resort settlements were formed after the opening of the railway services that enabled Narva-Jõesuu to receive summer residents from St. Petersburg, Aegviidu from Tallinn and Elva from Tartu.

In connection with the formation of the bourgeois-nationalistic state the economico-geographical position of Estonia changed fundamentally. As a result the conditions determining the development of the towns also changed. The largest economic centres on Estonian territory, the development of which had been in the closest way connected with the requirements of the whole of Russia, now diametrically changed the orientation of economic relations and essentially limited the scope of their sphere of influence. But at the same time their specialization changed comparatively little. The greatest qualitative change took place in the case of Pärnu, which after the destruction of the Cellulose Mill in World War I lost its importance as an industrial town and fell back into the same group as the rest of the local centres, or chief towns of districts (*maakonnalinnad*). After being isolated from the Russian market, Narva suffered a severe economic decline, but remained mainly an industrial town. The paralysing influence of the reduction of heavy industry on the development of Tallinn was to a certain extent compensated for by its change into the capital of the bourgeois state. This brought with it a considerable extension of its administrative (as well as economic) influence and a rise in its population.

The period of the Estonian bourgeois regime was not favourable to the development of the industrial settlements that had come into being in the 19th century and at the beginning of the 20th century. Some of them (Sindi, Kunda, Kärđla, Kohila) retained their former one-sided structure as "settlements with one factory".

the number of workers and correspondingly the size of the population in the settlements generally showing a tendency to decline. At Türi and Räpina the number of industrial workers remained practically the same, but these settlements grew as commercial, handicraft and transport centres. In connection with the development of the branches of industry based on the use of local resources a number of new industrial settlements came into existence: first of all in the oil-shale basin (Kohtla-Järve, Kiviõli, etc.), but also farther afield (e.g., Kehra in the neighbourhood of the Cellulose Mill founded in 1936).

The class differentiation of the peasantry that continued during the bourgeois-nationalistic regime created favourable conditions for the development of commercial-handicraft settlements, which belonged to the most rapidly growing urban settlements in Estonia during this period. At the same time certain differences could be observed in the functional specialization of these settlements.

A number of settlements in Southern Estonia (Otepää, Tõrva, Mustvee, Nuia, Suure-Jaani) became mainly places for the concentration of agricultural workers and artisans. 25—45 per cent of the population of these settlements earned a livelihood in agriculture, first of all by seasonal work on the great farms of the neighbourhood. Quite a number of artisans also lived in such settlements, but the development of trade in most cases remained comparatively slow (usually less than 10 per cent of the population was connected with trade).

The second group of commercial-handicraft settlements was characterized by the more prominent role of trade (the part of the population engaged in trade was about 15—20 per cent). It was especially high at Võhma, Jõgeva and other settlements which were situated near the railways and at the same time in regions of intensive agriculture. Owing to their favourable position they became outstanding centres of wholesale trade. The proportion of the agricultural population was in such market-towns usually smaller, especially in Northern Estonia. In Southern Estonia rare settlements of this type could be found in the vicinity of the railways, where both the percentage of the commercial as well as of the agricultural population was high (Abja-Paluoja). In the commercial centres many industrial enterprises were founded for the processing of the agricultural products that had been bought up. One of the largest among them was the Export Slaughter-House at Võhma, founded in 1929, owing to which Võhma became in its functional character nearly the same intermediate type between commercial, handicraft and industrial settlements as, for instance, Türi, though the trend (genesis) of the functional development of these two settlements was directly contrary.

A peculiar group of settlements was formed by the towns on the shores of Peipsi (Mustvee, Kallaste) where a great proportion of

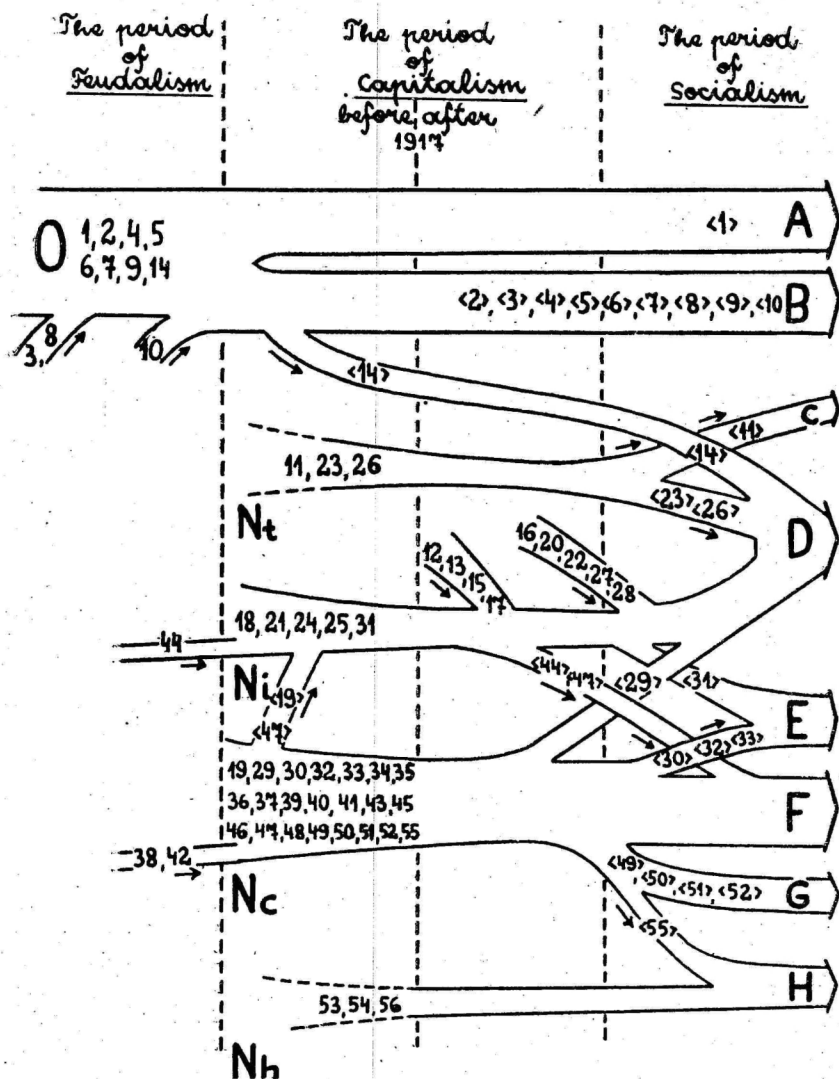


Fig. 2. The paths of development of the Estonian urban settlements.

- O — Old towns
- N — New urban settlements:
 - N_t — predominantly transport
 - N_i — predominantly industrial
 - N_c — predominantly commercial-handicraft
 - N_h — predominantly health-resort

the population made a living by fishing and vegetable-growing. Although Kallaste became a town in 1938, it still remained in essence a fishing village, the inhabitants of which also earned a living by cultivating the land, maintaining kitchen-gardens and working on construction sites in larger towns.

In tsarist times the new urban settlements officially remained in the category of rural settlements. In the years 1917—1926 twenty-two settlements were given the rights of boroughs (*alev*). In the years 1926—1936 some of the newly-founded boroughs were changed into towns, but in 1938 the boroughs as an administrative category were liquidated altogether and they were all renamed towns (except for Võõpsu that was left even without the rights of a borough). Yet many commercial and industrial settlements did not receive the status of an urban settlement from the bourgeois government. While the denomination of a town was given to commercial-handicraft settlements with a population of less than 1,000 (Keila, Mustla) by the statute of 1938, the large proletarian settlements in the oil-shale basin with populations of several thou-

A. Capital	<i>Kohila</i>	(18)	Põltsamaa	(42)
Tallinn (1)	<i>Kunda</i>	(19)	<i>Pärnu-Jaagupi</i>	(43)
B. District centres (towns of average size)	<i>Lavassaare</i>	(20)	<i>Räpina</i>	(44)
Haapsalu (2)	<i>Loksa *</i>	(21)	Suure-Jaani	(45)
Kingissepa (3)	<i>Maardu</i>	(22)	Tõrva	(46)
Paide (4)	<i>Mõisaküla</i>	(23)	Türi	(47)
Pärnu (5)	<i>Püssi</i>	(24)	<i>Vändra</i>	(48)
Rakvere (6)	<i>Sindi</i>	(25)	G. Local centres with inclination to agriculture	
Tartu ** (7)	<i>Tamsalu</i>	(26)	<i>Ambla</i>	(49)
Valga (8)	<i>Tootsi</i>	(27)	<i>Järva-Jaani</i>	(50)
Viljandi (9)	<i>Vüvikonna</i>	(28)	<i>Mustla</i>	(51)
Võru (10)	<i>Võhma</i>	(29)	<i>Nuia</i>	(52)
C. Transport town	E. District centres (small towns and boroughs)		H. Satellite or health-resort settlements	
Tapa * (11)	<i>Jõgeva</i>	(30)	<i>Aegviidu</i>	(53)
D. Industrial settlements	<i>Kärdla</i>	(31)	<i>Elva *</i>	(54)
(a) big or medium-sized	<i>Põlva</i>	(32)	<i>Keila *</i>	(55)
Kiviõli * (12)	<i>Rapla</i>	(33)	<i>Narva-Jõesuu</i>	(56)
Kohtla-Järve (13)	F. Settlements which served temporarily as district centres		<i>Kärdla</i> — town	
Narva (14)	<i>Abja-Paluoja</i>	(34)	<i>Põlva</i> — borough	
Sillamäe (15)	<i>Antsla</i>	(35)	* were also temporarily district centres	
(b) small industrial settlements	<i>Kallaste</i>	(36)	** University town	
<i>Järvakandi</i>	<i>Kilingi-Nõmme</i>	(37)	The classification given by V. Kaufmann (see footnote on p. 102) has been partly used.	
<i>Kehra</i> (17)	<i>Lihula</i>	(38)		
	<i>Mustvee</i>	(39)		
	<i>Märjamaa</i>	(40)		
	<i>Otepää</i>	(41)		

sands (Kohtla-Järve, Kiviõli) were ignored. Many commercial and industrial settlements from the end of the 19th century and from the beginning of the 20th century were left without the rights of an urban settlement, although the population of the largest among them (Rapla, Kohila, Abja-Paluoja, Vändra) equalled that of the smallest towns (about 1,000 people). The Municipal Law of 1938 was issued first of all with political aims to strengthen the power and to raise the authority of the bourgeois government. The above-mentioned law was a formal juridical act that neither reflected nor influenced essentially the actual economic development of the urban settlements.

The material presented above reveals that two basic genetic groups of urban settlements were formed on Estonian territory during the pre-socialist period. To the first group belonged the old towns that came into existence and acquired the rights of towns during the period of feudalism. During the differentiation in the capitalist period Tallinn and Narva remained the most prominent examples of this type; the former as the capital and the most important administrative, industrial, commercial, financial and transport centre; the latter as an industrial town. All the other old towns (except Paldiski) could briefly be characterized as chief towns of districts (*maakonnalinnad*). As to the professional structure of the population they were many-sidedly developed towns of a mixed type, whereas the great role of non-productive occupations (administrative-cultural functions) was rather noticeable. As to the social structure of the population the chief towns of districts were strongholds of the petty bourgeoisie, and here the role played by the proletariat was comparatively small. Having come into existence in the period when the territorial differences in the economic development of the Estonian area had only faintly taken shape and serving, as they did, mainly administrative and commercial interests, the old towns were distributed all over the country in the form of a more or less uniform network.

The second group among the Estonian pre-socialist urban settlements consisted of the new towns that were formed and were granted the rights of towns during the capitalist period. To this group also belongs a number of industrial, transport, commercial and health resort settlements that were officially changed into urban settlements only by the Soviet power. The functional structure of the new urban settlements was, as compared with the old towns, mostly more one-sided and the role of the administrative-cultural functions in their life was smaller. This group consisted of settlements that had already been functionally specialized from the moment of their coming into existence and they were classified according to the system of the territorial distribution of productive forces in capitalist Estonia. The majority of the industrial settlements were in Northern Estonia; most of the transport and health

resort settlements were also situated in this part of the country. Commercial-handicraft settlements as local centres of marketing were distributed somewhat more uniformly over the territory. But they were most dense in the central areas of Southern Estonia where hired labourers were widely employed in agriculture, and there were therefore many agricultural workers and handicraft settlements. Commercial-handicraft settlements occurred most sparsely in Western Estonia where the level of capitalist development in agriculture was low.

It was possible to distinguish rather clearly two basic genetic groups not only on the basis of the time of their coming into existence, their functional structure and the nature of their geographical distribution, but also on the basis of the size of their population. At the end of the capitalist period there were at least 4,000 inhabitants in all the old towns (except Paide, where the population fell little short of 4,000, and Paldiski), but among the new urban settlements Kohtla-Järve was the only one whose population exceeded 4,000.

3.

Before discussing the basic trends of development of the Estonian urban settlements during the years of Soviet power it is necessary to refer to the administrative re-arrangements in the network of towns. Under the Soviet power three settlements (Kohtla-Järve, Kiviõli, Sillamäe) acquired town status and twenty-five settlements that of a borough (*alev, посёлок городского типа*, i.e. a settlement of urban type).⁷ In some cases this marked the establishment of new socialist workers' settlements, but mostly it was the mere juridical registration of urban settlements formed already earlier. As a result the administrative differentiation of urban and rural settlements was brought into much closer conformity with economic reality. At present all settlements with a population of more than one thousand,² with the exception of only three (Aseri, Kadrina, Väike-Maarja), belong officially to the category of urban settlements. Of settlements with a population of less than one thousand also only three (Lavassaare, Ambla, Püssi) are urban settlements.

At the same time it is necessary to point out that the internal differentiation of urban settlements into towns and boroughs is not entirely in accordance with the size of their population and their economic importance. As a legacy of the mistaken admin-

⁷ Not taking into account the urban settlements that have been later united with larger towns or those changed into rural settlements. In the last column of the Table [Socialism] only the settlements having the status of a town or a borough are given, the towns being given in bold type.

² According to the census of 1959.

istrative practice of the bourgeois government a number of small settlements have retained the denomination of a town, although the number of their inhabitants is considerably less than that of the larger boroughs formed in the years of Soviet power. The division of the urban settlements of the Estonian S. S. R. into towns and boroughs depends most of all on their history: all the towns (except Kohtla-Järve, Kiviõli and Sillamäe) acquired the name of towns already before the establishment of Soviet power, but all the boroughs became boroughs only under Soviet power.⁸

In the conditions of Soviet power the social character of the Estonian towns as well their functional specialization changed in many respects. Below we shall only shortly refer to the basic trends of the further development of the types of towns formed in bourgeois Estonia.

The necessity for the planned management of a socialist national economy and culture augmented the importance of Tallinn as the capital in the life of the Republic. Tallinn became a town with varied and developed industrial, commercial-distributive, administrative-political and cultural functions which attracted incomers from all over the Republic and beyond. The population of Tallinn nearly doubled by 1963 in comparison with 1940. But this did not entail the hypertrophic development of Tallinn at the expense of other towns. The share of the capital in the total urban population of the Republic (including the population of the settlements that became towns only under Soviet power) has remained almost exactly the same (in 1940 it was 43 per cent, in 1963 — 42 per cent).

The post-war development of the former chief towns of districts (*maakonnalinnad*) is characterized by the further diversification of their functions, and by the considerable rise of their economic importance. Hand in hand with the expansion of old industrial enterprises a number of new ones were introduced. In the inland towns they were mainly machine and instrument-building enterprises (the Instrument Building Plant at Tartu, a shop of the Excavator Plant at Paide, a plant of gas analysers at Võru). At the railway junction of Valga, owing to its position on the southern frontier of the Republic, branches of industry have been developed which process half-finished products imported from the other Republics (the Combined Fodder Plant, the Wine Factory). In the seaside towns the fishing industry was created as a new branch of industry, the development of which has been especially intensive at Pärnu, where the largest fish-canning combine of our Republic has been built.

In 1950 the old administrative division into districts (*maakon-*

⁸ Except Narva-Jõesuu which was a borough already in 1917—1934, but belonged in 1934—1945 to the town of Narva.

nad) was replaced by a new one. The number of the new districts (*rajoonid*) was considerably greater than that of the old districts (*maakonnad*) and therefore the administratively subordinate territories of the former chief towns of districts were sharply decreased. But as various inter-district institutions and organizations continued to function there, these towns remained economico-organizational and cultural centres of territories that were considerably larger than their official administrative areas. During the reamalgamation of the districts in 1959—1962, all the former chief towns of districts retained their administrative functions and again acquired administratively subordinate territories of practically the same size as the former districts (*maakonnad*). Of the fourteen district centres ten were chief towns of districts already under the bourgeois régime (including Tallinn as the centre of the Harju district).

The size of the population increased 1.4—2-fold in the towns referred to during 1940—1963. Hence, the above-mentioned towns have retained their position among the leading towns of the Republic: in the conditions of Estonia today they are towns of average size, or large towns whose population exceeds 8,000 (except Paide), Tartu even having more than 80,000 inhabitants.

The most conspicuous fact in the development of the Estonian urban settlements under Soviet power is undoubtedly the rise of industrial settlements. In bourgeois Estonia there was only one large industrial town — Narva. But almost the whole of it was destroyed during the Second World War. Now two new socialist towns have arisen from the ruins of the former Narva. These are Narva (in the Estonian S.S.R.) and Ivangorod (Leninград Region, the Russian Federation) and their combined population is 2.5 times that of pre-war Narva. In addition to Narva three new industrial towns — Kohtla-Järve, Kiviõli and Sillamäe — have arisen from former industrial settlements of the oil-shale basin. Of the new post-war industrial settlements the town of Ahtme and the borough of Sompa, and of the earlier settlements Jõhvi, Kukruse and Kohtla have since merged with Kohtla-Järve. The population of this agglomeration has increased 8-fold as compared to that of the pre-war period, and therefore we have the right to treat Kohtla-Järve as an industrial town which has essentially risen during the socialist period. The same can be said of Sillamäe. The population of Kiviõli has nearly trebled as compared to the pre-war period. All the above-mentioned industrial towns now belong to the same size-group as the former chief towns of districts (*maakonnalinnad*), their population exceeding 8,000 (Kohtla-Järve having even 60,000 inhabitants).

The growth of the old industrial settlements and the rise of new ones under Soviet power could also be seen in other places, but in these cases it did not lead to the formation of centres

exceeding the limits of small towns. Thus, the population grew approximately three-fold in the cement-manufacturing centre of Kunda and in the cellulose- and paper-producing boroughs of Kehra and Kohila. Several new workers' settlements were established near enterprises that had existed earlier, but which considerably expanded their volume of production under Soviet power. At present the largest borough of the Estonian S. S. R. is Maardu, where a settlement of 5,000 inhabitants has risen near the chemical combine created on the basis of the phosphorite mines. The Järva-kandi Glass Works began to develop already in 1879, the Lavassaare Peat Plant in 1919, the Viivikonna Oil-Shale Plant in 1936, the Tootsi Peat and Briquette Plant in 1939. But it was only under Soviet power that populated centres worthy of the denomination of an urban settlement arose here and were given the rights of boroughs. The settlement of Sirgala created near the new oil-shale quarry is subordinated to the Borough Soviet of Viivikonna.

The relative importance of the industrial function has grown in the former industrial settlements of a mixed type (the industrial-transport settlements of Mõisaküla and Tamsalu, the industrial-commercial settlements of Loksa, Püssi and Võhma) and therefore they can now be united in the same group with other industrial settlements (Räpina is an exception).⁹ At the same time it can be noticed how in connection with the growth of population in industrial settlements of a pure type their functions become more diversified and their relations with the agricultural environment grow closer. This can be seen most clearly in the case of Kohtla-Järve, which is the administrative centre of a territory equal in size to a rural district (*rajoon*).

The transport function has retained the greatest role at Tapa, but even there it is no longer the only determining factor. From 1950 onwards Tapa was the centre of the local district (*rajoon*), but after the liquidation of the latter in 1962 Tapa has been an inter-district economic-organizational centre (a regional Party Committee of Industrial Production is located here). The population of the town has grown more than two-fold in comparison with the pre-war period.

Socialist reconstruction radically changed the economic basis of the former commercial-handicraft settlements. As a result of the collectivization in agriculture they lost their function as concentration centres for the reserve army of agricultural workers. The development of industry gathered momentum and in the case of this particular type of settlements usually found

⁹ V. Kaufmann: Väikelinnade arengust Eesti NSV-s, Zusammenfassung: Die Entwicklung kleiner Stadtsiedlungen in der Estnischen SSR. *Eesti NSV Teaduste Akadeemia Toimetised. Ühiskonnateaduste seeria*, Vol. XII, No. 2 (Tallinn, 1963), p. 113.

expression in the re-organization and expansion of the former small-scale and handicraft enterprises. The former industrial settlements of Kärđla and Türi relapsed into the category of small towns possessing no noteworthy industry, as the large-scale industrial enterprises destroyed during the war were not reconstructed there.¹⁰

A still greater stimulus than that of industrial development to the growth of the former commercial-handicraft settlements was the new administrative division into districts (*rajoonid*), in 1950. All the commercial-handicraft settlements that had acquired the rights of towns already in bourgeois Estonia (except Mustla, the smallest town in Estonia, with a bare 1,000 inhabitants) and the majority of the settlements of the same type that acquired the status of a borough under Soviet power (except Ambla, Nuia and Järva-Jaani) were changed into district (*rajoon*) centres. This change considerably stimulated the development of these settlements and favourably influenced the extension of construction work, and therefore it was now that some of them began to acquire the appearance of real towns. The relative increase in population has been especially rapid (approximately 1.7—3-fold, as compared to the pre-war level) in district centres of borough status¹¹ where the population was formerly small. Of the towns Keila and Elva grew rapidly (more than threefold in 1940—1963), but this was mainly due to their proximity to Tallinn and Tartu, whose residential suburbs they became. The number of inhabitants has increased 1.7—2-fold at Jõgeva and Kärđla which had previously acquired the functions of administrative centres (Kärđla in 1946, and Jõgeva in 1949, as the district centres of Hiiumaa and Jõgevamaa respectively) and have retained them up to now. The growth of Türi has been as rapid as that of the other towns. In the other former commercial-handicraft settlements, the size of the population has increased more slowly (less than 50 per cent in 1940—1963).

As a result of the amalgamation of the districts in 1959—1962 almost all the district centres formed from commercial-handicraft settlements again lost their administrative functions. Now only the towns of Jõgeva and Kärđla and the boroughs of Rapla and Põlva have remained district centres. Lately the population has evinced a certain tendency to decline in some of the settlements that were temporarily district centres and the problem of the ways and prospects of the further development of these settlements has attracted much attention.

¹⁰ A branch of the Volta Electric Motor Works was recently (1961) set up near Türi.

¹¹ In 1934—1963 the number of inhabitants increased in the above-mentioned settlements 1.8-fold (Abja-Paluoja) to 4.2-fold (Põlva).

Generally speaking, the former commercial-handicraft settlements (though officially towns or boroughs) belong to the category of small urban settlements. But there is little difference in size between the settlements retaining the functions of district centres and those having lost them: the population of the settlements belonging to the former group ranges from 1,500 to 3,500, and that of the latter group between 1,000 and 4,500,¹² while the average number of inhabitants is 2,400 in both groups. The last figure is approximately equal to the average size of the small industrial settlements (2,600 inhabitants). Considerably smaller are those former commercial-handicraft settlements that have never been district centres and the main role in whose life is played by agriculture and enterprises processing local agricultural products (Ambla, Mustla, etc.). The number of inhabitants in the settlements of this group is 750—1,500 (the average figure being 1,100).

The former large health-resort settlements (Narva-Jõesuu, Aegviidu) have now ceased to exist as an independent type of settlements and have merged into the same type as the 'satellite settlements' of the larger towns (Keila, Elva).¹³ As a rule this group includes settlements with a population of 3,000—6,000 (except for Aegviidu, where the number of inhabitants is smaller), the average size of the population being 3,500 inhabitants.

As may be seen from the material presented above, it is possible in many cases to establish a rather evident genetic continuity between the types of towns formed in bourgeois Estonia and the contemporary groups of settlements. And this is only natural if one recalls that the continuous building of socialism has not yet lasted for twenty years in the Republic, and therefore the basis inherited from capitalism still has a greater influence on the life of the towns here than in most other parts of the Soviet Union. But at the same time the grouping of towns in the socialist period as given in the present article (and in the appended Table) still cannot be regarded as a genetic classification of the contemporary urban settlements of the Estonian S.S.R. In the Table the author has tried to show the transformation, under socialist conditions, of the groups of urban settlements formed during the pre-socialist period. But owing to the scarcity of material he has not ventured to discuss the further functional differentiation within the groups themselves, which in some cases (e.g. district centres of average size and settlements that were temporarily district centres) has been undoubtedly great.

¹² Except for Türi, where the number of inhabitants is greater.

¹³ V. Kaufmann, *op. cit.* [see footnote 9 above].

EESTI LINNALISTE ASULATE ARENGUTEEDEST JA GENEETILISEST KLASSEERIMISEST

T. Rea

Resümee

Käesolevas artiklis on valgustatud järgmisi küsimusi: 1) linnade klassifitseerimise geneetilise printsiibi tõlgendus, 2) selle tõlgenduse rakendus sotsialismieelse Eesti linnadele ja 3) Nõukogude Eesti linnaliste asulate põhisuundade iseloomustus. Esimeses küsimuses on autor oma varasemaid seisukohti (vt. 87. lk., 1. viide) mõnevõrra täpsustanud, arvestades avaldatud kriitikat (vt. 87. lk., 2. viide). Teist küsimust käsitletakse endisel kujul, kuna kolmandas küsimuses on artiklit täiendatud uue materjaliga.

О ПУТЯХ РАЗВИТИЯ И ГЕНЕТИЧЕСКОЙ КЛАССИФИКАЦИИ ГОРОДСКИХ ПОСЕЛЕНИЙ ЭСТОНИИ

T. Rea

Резюме

В статье дается: 1) трактовка генетического принципа классификации городов, 2) применение указанного принципа к городам досоциалистической Эстонии, 3) характеристика главных направлений развития городских поселений в Советской Эстонии. В первом вопросе автор несколько уточнил свои прежние высказывания (см. 1. сноску на стр. 87), учитывая опубликованную критику (см. 2 сноску на стр. 87). Второй вопрос рассматривается с прежних позиций. По третьему вопросу статья дополнена новыми материалами.

COUNT L. A. MELLIN AND HIS "ATLAS OF LIVONIA"

E. Varep

During the last few years considerable attention has been devoted in Tartu State University to questions relating to the history of the geographical study of Estonia. This is quite understandable in view of the fact that this branch of research had previously constituted an almost virgin field. Investigations carried out in this sphere have already led to results which may prove to be of broad scientific interest. This is especially true of the work of Count Mellin, one of the outstanding cartographers of his time, whose scientific activities merit more general recognition than they have hitherto received.

In the history of the geographical study of Estonia Count Mellin is a figure of great interest. He is the author of the "Atlas of Livonia",¹ an outstanding cartographical work dating back to the eighteenth century. He also deserves attention as a public figure who made no secret of his sympathy for the Estonian people and did all in his power to alleviate the lot of the Estonian and Latvian peasants, who were serfs at that time.

Count Mellin and his "Atlas of Livonia" have been objects of interest to the author of the present article for a number of years already. The results of his findings have been partly published in a few earlier papers on the background of the history of Estonian cartography. This last contribution purports to give a more complete survey of Mellin's life and work than

¹ Atlas von Liefland oder von den beyden Gouvernementern u. Herzogthümern Lief- und Ehtland und der Provinz Oesel. Entworfen nach geometrischen Vermessungen, den neusten astronomischen Beobachtungen und nach sorgfaeltiger Untersuchung und Kentnis der Gegenden. Das ganze besteht aus einer Generalkarte und vierzehn Kreiskarten. Von Ludwig August Graf Mellin, Landrath des Herzogthums Liefland, Director u. Präses des Kaiserlichen Lief- laendischen Ober Consistorii, Mitglied der Lief-laendischen gemeinnützigem und ökonomischen Societät und Ehrenmitglied des Instituts der Wissenschaften und schoenen Künste zu Bologna. Riga und Leipzig bey Johann Friedrich Hartknoch. MDCCLXXXVIII.

any of the preceding,² and also includes new data that have emerged during the past few years.

I The Historical Background

The scientific investigation of the Baltic provinces, to which our country also belonged in the past, was initiated by Peter I early in the eighteenth century. The first investigators sent by the tsarist government started work in Estonia shortly after the incorporation of the area to Russia in the course of the Northern War. When the war came to an end, research work was continued in connection with the defence of St. Petersburg, the new capital of the Russian Empire. Investigations were chiefly carried out by the central state institutions, such as the Admiralty, Senate and Academy of Sciences. The role of local scholars was as yet negligible. Indeed in the first half of the eighteenth century the territory of the Baltic provinces was studied mainly by Russians.

The rapid progress of the economy of the Baltic provinces in the second half of the century set a premium on the scientific study of the area. The development of commercial relations in farming, the rationalisation of agriculture and the promotion of local manufacture called attention to the need for more effective exploitation of both natural and labour resources, and thus stimulated a more detailed study of the territory and population of the provinces of Estonia and Livonia.

At that time the Department of Geography of the Academy of Sciences of St. Petersburg was the centre of geographical exploration in the Russian Empire, including the Baltic countries. On the initiative of the great Russian scientist M. Lomonosov, the Academy of Sciences had begun to organize the collection of statistical and economic data, which paved the way for the complex study of the natural resources of Russia. This undertaking stimulated the local investigators, who now began to take a hand in the work. From the seventies of the eighteenth century onwards,

² E. Vares: L. A. Mellini Liivimaa atlas ning selle tähtsus Eesti NSV territooriumi geograafilise uurimise ajaloos. Резюме: Атлас Лифляндии Л. А. Меллина и его значение в истории географического исследования территории Эстонской ССР. *Eesti NSV Teaduste Akadeemia Toimetised*, Vol. IV, fasc. 2. (Tallinn, 1955), pp. 300—316. — *Idem*: Л. А. Меллин и его «Атлас Лифляндии». *Труды Института истории естествознания и техники*, fasc. 27 (Moscow, 1959), pp. 265—269. — *Idem*: Исторический очерк картографии Эстонии (до 1917 года). Резюме: Eesti kartograafia ajaloost. Summary: From the history of Estonian cartography. *Tartu Riikliku Ülikooli Toimetised*, fasc. 88 (Tartu, 1960), pp. 62—79. — *Idem*: Jooni Eesti kartograafia ajaloost. Резюме: Исторический очерк картографии Эстонии. Zusammenfassung: Zur Geschichte der Kartographie Estlands. *Eesti Geograafia Seltsi Publikatsioonid*, Vol. I (Tallinn, 1960).

a notable expansion of research work could be observed in the Baltic countries, especially as regards the provinces of Estonia and Livonia.

An outstanding investigator of the Baltic provinces at this time was August Wilhelm Hupel (1737—1819), who originated from Germany, but was for years pastor of the parish of Põltsamaa (Oberpahlen) in Estonia. A man of wide interests and



Fig. 1. August Wilhelm Hupel.

boundless energy, Hupel (Fig. 1), soon rose to be one of the most important Baltic authors of the eighteenth century. The number of works published by him was very great and their subject-matter extremely varied. In the field of geography his "Topographical Reports" (in three parts with a supplementary volume) are of the greatest significance. This extensive collection

of historical, geographical and economic data, the compilation of which occupied Hupel over a great number of years,³ contains copious materials on a wide variety of cognate subjects.

Among the other authors of the period mention should be made of Jakob Benjamin Fischer (1731—1793), Karl Philipp Snell (1753—1806), Wilhelm Christian Friebe (1762—1811), Johann Christoph Petri (1762—1851), and Garlieb Helwig Merkel (1769—1850). Fischer, a pupil of the renowned Linnaeus, compiled the first extensive work on Livonia covering various branches of natural science.⁴ Snell, Friebe and Petri dealt mainly with political, ethnographical and economic problems. Petri and Merkel in particular have become known as fervent fighters against serfdom.

W. Chr. Friebe, a journalist of wide interests and a typical product of the Age of Enlightenment, published a number of works on the history, geography and economy of the Baltic countries. Collaboration between Mellin and Friebe was very close over a period of many years, as they had many scientific interests and aims in common. Friebe compiled a map illustrating the earlier history of Baltic region (up to the year 1562), which Mellin added as a supplement to his atlas. In 1791 the Independent Economic Society (*Вольное экономическое общество*) in St. Petersburg, to which Hupel, Fischer, and Mellin himself belonged, offered prizes for the best economic descriptions of one of the provinces or governments of the Russian Empire. Friebe wrote a geographical and economic survey of Livonia and Estonia and presented it as a prize-essay to the Independent Economic Society. The essay was printed in an extended form in 1794.⁵ When Friebe was compiling this study, he obtained much valuable information from Mellin, to whom he dedicated his work.

An outstanding part in the development of science in the Baltic area was played by the Livonian Society of Public Utility and Economy (*Livländische Gemeinnützige und Ökonomische Societät*). This Society was founded at Riga in 1792 after the pattern of the Independent Economic Society of St. Petersburg, but did not actually begin its activities until 1796. The first secretary of the Society was G. F. Parrot, who in 1802 became the first *Rektor* of Tartu University. Later Friebe himself was for many years secretary to the Society, which contributed greatly to the development of agriculture in the Baltic countries, as well as to the investiga-

³ A. W. Hupel: *Topographische Nachrichten von Lief- und Ehistland*, Vol. I—III (Riga, 1774, 1777 and 1782). — *Idem*: *Die gegenwärtige Verfassung der Rigischen und der Revalschen Statthalterschaft. Zur Ergänzung der Topographischen Nachrichten von Lief- und Ehistland* (Riga, 1789).

⁴ J. B. Fischer: *Versuch einer Naturgeschichte von Livland* (Leipzig, 1778; sec. ed., Königsberg, 1791).

⁵ W. Chr. Friebe: *Physisch-ökonomisch' und statistische Bemerkungen von Lief- und Ehistland oder von den beiden Statthalterschaften Riga und Reval* (Riga, 1794).

tion of the territory in various fields of natural science. Mellin was a member of the Society for some time, but resigned in 1807, when the reactionary landlords got the upper hand in the Society.

Alongside the works of A. W. Hupel and J. B. Fischer a major achievement in the field of geography and natural sciences in the Baltic countries at the end of the 18th century was the publication of the "Atlas of Livonia" by L. A. Mellin. It was the first complete cartographical work on the Baltic provinces, and did much to stimulate the subsequent geographical exploration of the territory. The achievements of a great many Russian cartographers, in particular many atlases of governments compiled in the last quarter of the 18th century, served Mellin as a model in his work. It should also be pointed out that at the end of the eighteenth century a school of Russian military topographers had begun to develop, to which Mellin also belonged.

II Mellin's Life and Activity

Ludwig August Mellin (Fig. 2) was born on the estate of Tuhala (Toal) in the region of Harjumaa (Harrien), Estonia, on January 23, 1754.⁶ He grew up in a family where the ideas of the Age of Enlightenment had taken root, and this circumstance seems to have strongly influenced his mental development in early youth.

As a result of a series of felicitous coincidences, young Mellin was able to receive, in the company of the princes of Holstein-Gottorp, an excellent education for that time. The orphan princes of Holstein-Gottorp, who were relatives of Catherine II of Russia, were educated at the expense of the Empress in Switzerland and Italy. Young Mellin was sent there as a companion to the princes, thanks to the intercession of his uncle, who acted as their guardian tutor.

In the years 1769—1773 Mellin studied at the University of Bologna. Here he seems to have been particularly interested in mathematics, though he also studied a number of other subjects and devoted much of his spare time to his favourite pastime of

⁶ The main sources for Mellin's life are the following: L. A. Mellin: *Meine Selbstbiographie*, MS in the library of the Academy of the Latvian S. S. R., Riga. Partly published in an article by H. Diedrichs: *Des Grafen August Ludwig Mellin Selbstbiographie*. Separat-Abdruck aus dem *Rigaer Tageblatt* (Riga, 1897). — C. E. Pegau: *Biographie von Ludwig August Graf Mellin*, MS in the library of the Academy of the Latvian S. S. R., Riga. — J. F. Recke u. K. E. Napier sky: *Allgemeines Schriftsteller- und Gelehrten-Lexikon der Provinzen Livland, Esthland und Kurland*, Vol. III (Mitau, 1831), pp. 190—199; see also *Nachträge und Fortsetzungen von Th. Beise*, Vol. II (Mitau, 1861), p. 39. — *Mittheilungen aus dem Gebiete der Geschichte Liv-, Ehst- und Kurland's*, Vol. I (Riga u. Leipzig, 1837), pp. 37—43. — J. Eckardt: *August Ludwig Graf Mellin*, an article published in the *Rigasche Zeitung*, 1868, nos. 271—275.

music. Together with the princes he had the opportunity of travelling extensively in Switzerland and Italy, where he made the acquaintance of many prominent personages of that time, among others Voltaire.

Mellin returned to Russia at the end of 1773, joined the Army and was appointed to serve on the General Staff, set up by Catherine ten years before. In 1774 he took part in the campaign against Turkey. Thereafter he served in the rank of lieutenant in the Drawing Office of the General Staff. In 1776 the Crown Prince Paul,



Fig. 2. Count Mellin.
Portrait by Johanna Gerling (1823).

who had become acquainted with Mellin through the princes of Holstein-Gottorp, assigned him the task of mapping the environs of Pavlovsk. After the successful performance of this duty he was promoted to the rank of captain. On an errand of Catherine II he went to Germany in 1777. After that he was appointed head of the Drawing Office of the General Staff and was sent to southern Russia to superintend the erection of some fortifications. Then followed the war of the Bavarian Succession, and he was unable to return to St. Petersburg till 1779.

During his service on the General Staff, where he was engaged chiefly in the field of cartography, Mellin acquired wide experience and attained a high degree of proficiency in the subject. This enabled him later to tackle the job of compiling an atlas of his native country, Livonia.

Soon afterwards Mellin was transferred at his own request to Riga, where he was appointed Quartermaster of the Livonian Division. In 1781 he married the daughter of Lieutenant-General Mengden, who owned the estates of Bīrini (Koltzen) and Eikaži (Eikasch) near Riga. Having received a year's leave, he made a trip to Germany, where he studied at Göttingen University. Returning to Riga, he served in the Army for only a short time longer. In 1783, having attained the rank of major, he retired from active service, and devoted himself entirely to his social and scientific labours.

Mellin's subsequent life and activities were closely connected with Riga, the largest economic and political centre of the Baltic countries. At that time Riga was also an important centre of culture, which was linked by numerous ties with the main seats of learning of Western Europe.

A characteristic picture of the life and customs of that time in Riga has been given by Karl Philipp Michael Snell, who from 1780 to 1787 was Principal of the *Domschule* of Riga. At that time Riga was the second largest port in Russia after St. Petersburg. Merchants had settled down there in great numbers and their guilds played a leading part in the life of the town, so that even the aristocracy were constrained to follow their lead. There were large libraries and art museums there. Snell points out that a great variety of economic, political, literary and scientific problems were widely discussed at that time, while Mellin himself is represented by Snell as one of the outstanding personages of Riga society.⁷

Living alternately in Riga and on his estate of Bīrini, Mellin not only carried out intensive scientific work, but also played an active part in the social and political life of the town. He served as both circuit judge and court assessor, taking his duties in both capacities very seriously, which was by no means always the case at that time.⁸ Later he was elected *Landrat* of the government of Livonia. As a political figure he strove, as far as was then possible, to create more favourable conditions for the peasantry, often in so doing coming into conflict with the reactionary wing of the landed gentry.

The compilation of the "Atlas of Livonia" occupied Mellin over a long period; and for many years he devoted all his spare time to this undertaking. On its publication Mellin won widespread recog-

⁷ K. Ph. M. Snell: Beschreibung der russischen Provinzen an der Ostsee (Jena, 1794), preface, pp. 119—120 and 283—330.

⁸ Я. Зутис: Остзейский вопрос в XVIII веке (Рига, 1946), p. 489.

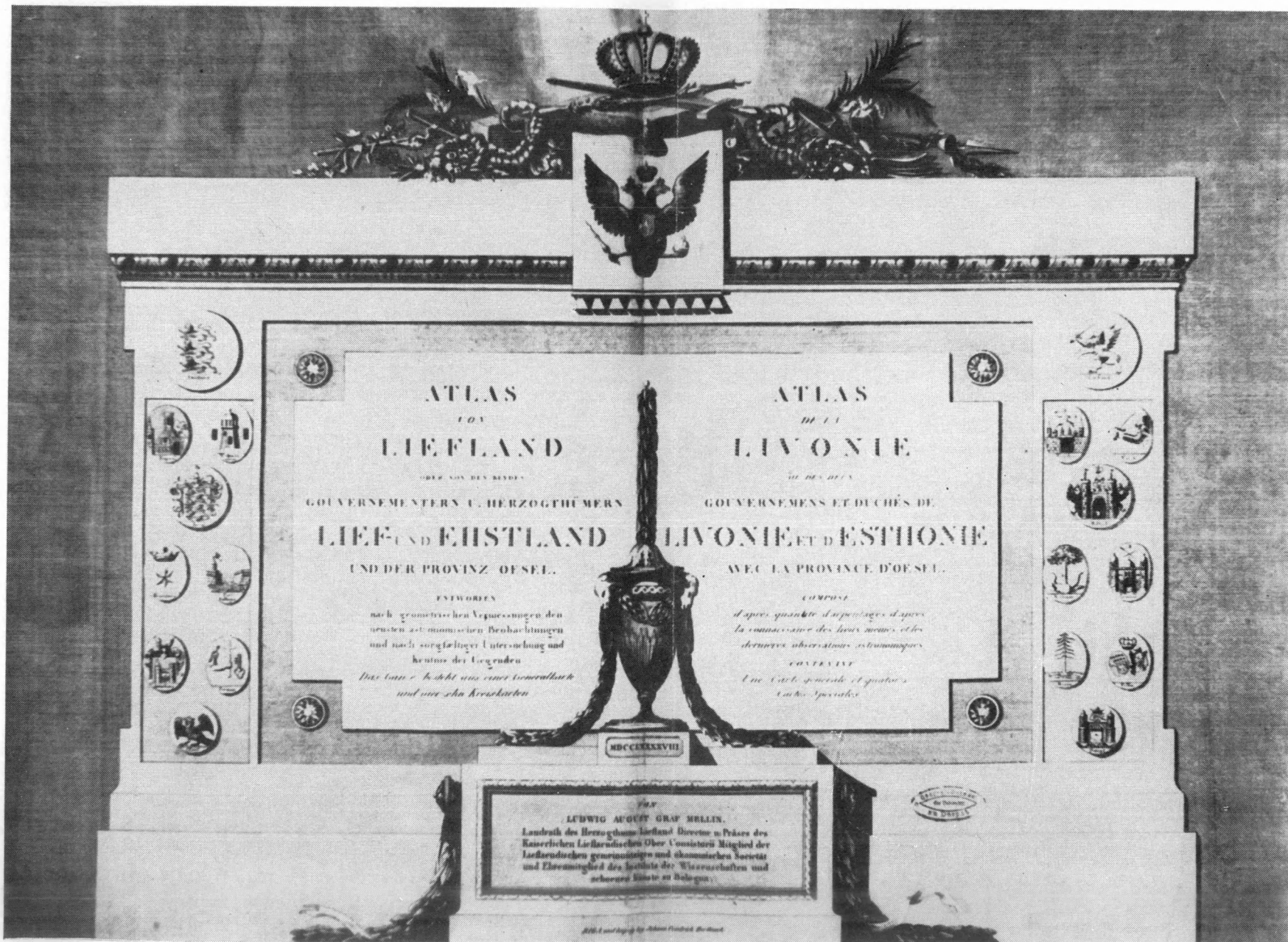


Fig. 3. Frontispiece of Mellin's "Atlas of Livonia," designed by Johann Wilhelm Krause; after the original in Tartu University Library.

dition, and he was elected to the membership of several scientific societies at home and abroad, such as the Independent Economic Society of St. Petersburg, the Society of Naturalists in Moscow, the Economic Society of Leipzig, etc.

But Mellin's scientific interests were by no means confined to this cartographical achievement, on which his fame now mainly rests. He also published a large number of scientific and popular writings on a variety of different subjects. In general he wrote with ardour, as we may infer from the imposing quantity of papers which are preserved in manuscript form at the Central Library of the Academy of Sciences of the Latvian S. S. R.

Of the numerous writings from his pen separate mention may be made of an exhaustive description of the ancient Estonia fortress of Varbola; to which is appended a detailed map of the site.⁹ This was the first work of its kind in Estonian historico-geographical research. Treating the old fortresses of Estonia as outstanding historical monuments testifying to the bravery and patriotism of the men who constructed them, Mellin concludes: "History shows that the Estonians were a warlike, brave, daring and free people who, under the leadership of their chiefs, fought for their freedom and property to the last ounce of their strength, and who even later made repeated efforts to throw off the yoke imposed on them." Sympathetic references to the Estonians may be found in a number of other works, and Mellin was, incidentally, one of the first scholars who studied and set down in writing the folk tunes and traditional songs of the Estonian peasantry.

In a series of articles Mellin dealt with the acute agricultural problems of his time. For a prize essay on the utilization of horses and oxen in ploughing he was awarded a gold medal by the Independent Economic Society of St. Petersburg.¹⁰ He took particular interest in all kinds of technical innovations. Nor should we omit to mention his studies of the relations between electric and magnetic phenomena, based on his own first-hand observation. These investigations were subsequently published in the transactions of the Moscow Society of Naturalists.¹¹

Mellin's essays on the social problems of his time are by no means void of interest. His political views concerning the native

⁹ L. A. Mellin: Nähere Beschreibung der alten ehstnischen Burg Warbola. *Nordische Miscellaneen* von A. W. Hupel, Vol. XV—XVII (Riga, 1788), pp. 735—743.

¹⁰ L. A. Mellin: Ueber den Gebrauch der Pferde und Ochsen beim Pflügen, wie auch anderweitigen Anspann bei den Bauern. *Livländische Jahrbücher der Landwirtschaft*, Vol. VI, fasc. 3 (Dorpat, 1831), pp. 341—358.

¹¹ Observations sur la combinaison de la matière électrique avec la magnétique, par Mr. le Comte Auguste Mellin. *Mémoires de la Société Impériale des Naturalistes de Moscou*, tome troisième (Moscow, 1812), pp. 187—189. — See also: Merkwürdige Naturbegebenheit. *Nordisches Archiv*, Vol. II (Riga and Leipzig, 1803), pp. 196—201.

peasantry are set forth in two writings — an anonymous article published in 1822¹² and a book printed at the author's expense two years later.¹³ In these works Mellin expounds in detail the grounds of his conflict with the Livonian gentry. The latter publication in particular evoked the sharp disapproval of the ruling classes and its distribution was forbidden in Russia.

Mellin belonged to that section of the Baltic aristocracy which had to a greater or lesser extent been imbued with the bourgeois ideas of the Age of Enlightenment. In the conditions of a deepening crisis in the system of serfdom itself at the turn of the eighteenth and nineteenth centuries, Mellin, together with many others, convinced that the system of serfdom could not persist for ever, began to seek new ways and means of mobilising the national economy and exploiting it in a rational way. Many economic and social innovations introduced on his estates of Bīrini and Eikaži long before the enforcement of the new peasant laws served the same ends.

The reactionary party violently disapproved of these innovations, although they were, on the whole, extremely modest. Mellin was reproached with setting a dangerous example to the peasants and with the dissemination of madcap projects which were impossible of fulfilment. For his part he vigorously refuted the accusations levelled against him, wrote of the need of making amends to the native population, which had been unjustly dispossessed of its liberty and property by the German invasions of the early Middle Ages, and insisted on the improvement of the economic and legal status of the peasantry. Mellin particularly stressed the need for placing the relations between peasant and landlord on a firm legal basis, with the aim of putting an end to tyranny and oppression in the countryside. On the issue of the liberation of the peasantry, Mellin seems to have favoured a solution which would have ensured every peasant the right to take full legal possession of the land in his tenure.

In 1792 Mellin submitted to the assembly of the landlords of Livonia a number of proposals on the peasant question which created a considerable stir among the aristocracy. Owing to the bitter opposition of the reactionary wing, these proposals were not even brought up for discussion. But in subsequent years the growing resistance of the peasantry forced both the landlords and the government to pay more attention to the problem of reforms. This led to a split between the liberal and reactionary wings of the aristocracy, which became involved in a violent controversy. Mellin took an active part in this struggle, particularly from 1797 on-

¹² Einiges über die Bauer-Angelegenheiten in Liefland. *Isis*, Vol. II (Jena, 1822), pp. 1145—1151.

¹³ L. A. Mellin: Noch Einiges über die Bauernangelegenheiten in Liefland. Mit einer Schlussbemerkung (Riga, 1824).

wards, when he was elected *Landrat* of the Livonian provincial government. The conflict came to a head during the struggle for the preparation and implementation of the 1804 peasant law of Livonia. The reactionary party was prepared to go to all lengths to remove its political antagonists from its path, and Mellin was one of those who stood most in danger.

In 1813 Alexander I appointed Mellin to the Peasant Committee of Livonia. Here he resolutely opposed the persistent attempts of the reactionaries to evade and frustrate the peasant law with all the means at their disposal. He demanded strict observance of the law, especially on the questions of providing public buildings and furnishing the recruits with provisions. Finally, in a private letter to the State Counsellor Kaisarov, in St. Petersburg, Mellin appealed for government support. This step, however, served as a pretext to Mellin's enemies, who forced him in 1818 to resign from the Peasant Committee and to give up his post in the provincial government.

Thereafter Mellin withdrew from political life. He died at the age of 82 in Riga on March 12, 1835.

III Mellin's "Atlas of Livonia"

The appearance of the "Atlas of Livonia", compiled by Count Mellin, was an important event in the history of geography in the Baltic provinces. This wonderful atlas has not lost its fascination right up to the present day. At the same time it remains an indispensable source of information for the study of the historical geography of Estonia and Latvia.

Mellin's atlas consists of the following parts: the title-page (Fig. 3); a four-page preface; a general map of the provinces of Livonia and Estonia; large-scale maps of Livonia, including the districts of Riga, Cēsis (Wenden), Valmiera (Wolmar), Valga (Walck), Võru (Werro), Tartu (Dörpt), Viljandi (Fellin), Pärnu (Pernau) and Kuressaare (formerly Arensburg, since renamed Kingissepa); similar maps of Estonia, including the districts of Tallinn (Reval), Paldiski (Baltischport), Rakvere (Wesenberg), Paide (Weissenstein) and Haapsalu (Hapsal). A historical map of Livonia illustrating the period preceding 1562 and compiled by W. Chr. Friebe was added as a supplement. The sheets are imperial folio (57 × 78 cm). The title-page, preface and map headings, as well as other explanatory notes, are in both German and French.

Complete specimens of the atlas are now rare, and the sequence of the maps in various copies is different. The reason for this is the fact that work was published in instalments over a comparatively long period. A fine copy of the atlas, containing a personal dedication inscribed by the author himself, is preserved in the University Library at Tartu.

The points that serve as the mathematical basis for the maps were astronomically determined. According to Friebe, Mellin mainly used the determinations of Major-General von Laurenberg, in certain cases only those of the Academy of Sciences.¹⁴ The geographical co-ordinates of some district centres and a few other places were determined astronomically by Mellin himself. The district maps are on a scale of approximately 1 : 200,000. The geographical longitudes are given from the Ferro meridian.

In accordance with the requirements of practical utility the main stress was laid on the presentation of the administrative divisions, settlements and roads. The coastline is remarkably accurate with the exception of certain stretches on the west and north coasts of Estonia, and the northern shore of L. Peipsi (Peipus). Islands, reefs and shallows, rivers, lakes, prominent elevations, swamps, forests, sandy areas and dunes are copiously reproduced. Villages and settlements, fortified and unfortified towns, castles, parish churches and chapels, manors, leaseholds and church lands, public inns, wind- and water-mills, etc. are all scrupulously entered. Harbours, frontier-guard cordons, and lighthouses are marked separately. Numerous historical monuments, such as ruined castles and churches, battle-fields, ancient fortresses, burial-places, etc., are clearly indicated. Postal routes, highways, parish roads and country lanes are distinguished. The boundaries of governments, districts and parishes are given. Abundant place-names have been added with Estonian and Latvian names figuring alongside their German equivalents. As far as we know Mellin is the first map-maker to use Estonian toponymics.

The cartographic materials which Mellin was able to use in compiling his atlas were very sparse. He is known to have consulted the maps of the Livonian and Courland frontiers, together with their descriptions as compiled by Russian military topographers. Maps of private estates were extensively utilised. Mellin succeeded in awakening the interest of many leading public figures of Livonia and Estonia. These in their turn helped him to employ the district surveyors in pursuance of his enterprise. In particular he seems to have received considerable assistance from Count George Browne (1698—1791), the scion of an ancient noble Irish family, who long occupied the post of Governor-General of Livonia and Estonia. A first-rate administrator, who took particular care of the maintenance of the roads and bridges, he was evidently keenly interested in Mellin's atlas. Incidentally, Browne also showed great consideration for the native peasantry within the limits of the possibilities at his command, and carried out a number of

¹⁴ W. Chr. Friebe, *op. cit.*, p. 6.

reforms with the object of alleviating the worst abuses of serfdom in the countryside.

Mellin also widely practised the collection of materials by post. In the preface to his atlas he enumerates the names of no less than 202 prominent persons from both provinces — pastors, estate-owners, representatives of the provincial government offices, etc., whose assistance he desired to acknowledge. Amongst others we may find the names of A. W. Hupel, W. Chr. Friebe, O. W. Masing, etc. In quest of the necessary data, Mellin visited many places on the spot, although he engaged in actual topographical work only in a few restricted areas.

With the help of his numerous correspondents, Mellin amassed voluminous — though unfortunately in certain instances inaccurate — geographical data on Livonia and Estonia. Indeed many major errors have crept into his work. Mellin was conscious of the defects of the materials supplied to him by his correspondents and accepted them with all due reserve. Thus he published an excerpt from a letter by J. F. Rauch, pastor of the parish of Viru-Jaagupi (St. Jacobi), in which the reverend gentleman in question announced the existence of two extinct volcanoes or "fire-hills" in his parish, both of which bore the name of *Linnamägi* (i.e. 'town hill'). Mellin suggested that both hills should be regarded as ancient fortresses. Nevertheless, on the map of the Tartu district, not far from the settlement of Tudulinna (Tuddolin), we find the note "*Līna Mäggi, ein erloschener Volcan*" (i.e. '*Linnamägi*, an extinct volcano'). This error was eliminated from the map of the Rakvere district, which was published later.¹⁵

It would seem that Mellin's closest assistant in the compilation of the atlas was Johann Wilhelm Krause (1757—1828), an architect and engineer. Krause was born in Silesia; afterwards he worked for the city architect of Zittau, attended Leipzig University and took part as Ordnance officer in the American Civil War. In 1787 he came to Livonia and spent the years 1792—1797 in the service of Count Mellin. As appears from his autobiography, he contributed to the compilation of the atlas over a number of years.¹⁶ Some map sketches by Krause are still extant, e.g. a sketch of the environs of Salacgrīva, which obviously served as the basis for the map of that area in Mellin's atlas.¹⁷ Later Krause became professor of architecture and economics at Tartu. He was the

¹⁵ L. A. Mellin: Nachricht von der alten lettischen Burg Pilliskaln und von mehrern ehemaligen festen Plätzen der Letten und Ehsten; auch von etlichen andern lief- und ehstländischen Merkwürdigkeiten. *Neue Nordische Miscellaneen*, Vol. IX—X (Riga, 1794), pp. 519—545. — See also Nachricht über den rauchenden Berg der sich 22 Werst südwestlich von Reval befindet. *Nordisches Archiv*, Vol. I (Riga, 1808), pp. 178—191.

¹⁶ J. W. Krause: Wilhelms Erinnerungen, Vol. IX. MS in the library of Tartu University.

¹⁷ *Ibid.*, pp. 134—135.

designer and builder of the main edifice of Tartu University, and of many other university buildings.

The maps in Mellin's atlas are copiously illustrated with vignettes representing views of towns, landscapes and scenes from popular life. They are worthy of notice not only for their artistic value, but also from the point of view of history and ethnography (Fig. 5). It is uncertain to whom these sketches should be attributed, and some of them may have been drawn by Mellin himself. The frontispiece and the vignette on the map of the district of Rakvere were designed by Krause, who also drew Friebe's historical map and illustrated a few other works by Mellin. The vignettes on the maps of Haapsalu and Viljandi bear the names of Meyer and Jügel respectively.

Unfortunately not all of the engravers have perpetuated their names on the atlas sheets. The maps were engraved in Germany, the chief engravers being: Carl Jäck (Berlin) — the districts of Riga, Valmiera, Valga, Tartu, probably also those of Cēsis and Võru; Carl Jätting (Berlin) — Viljandi, Pärnu and Haapsalu; J. N. Champion (Leipzig) — Paldiski and Paide; F. G. Franz (residence uncertain) — Kuressaare; F. Guimpel (Berlin) — Tallinn, and J. B. Hoesset (Weimar) — Rakvere. Friebe's historical map was engraved by F. Ramberg. The engravers of the general map and of the title-page are unknown. The work of J. N. Champion and F. G. Franz attained an exceptionally high standard and their maps are remarkable for the care and finish of their execution.

Technically speaking, the maps are well finished. Mellin himself, as did also his critics, singled out the map of the district of Kuressaare as being exceptionally accurate and delicately drawn.¹⁸ One of the reasons for the high standard attained in this particular case was that Mellin was able to make copious use of the cartographic materials collected by the members of the Land Measurement and Regulation Committee which had worked on the island of Saaremaa under the leadership of J. B. von Campenhausen, Vice-Governor of Livonia.

One of the chief defects of the maps is their lack of a sound geodetical basis. Neither are the maps based on the results of surveys carried out on the spot. For the most part they were compiled from the data preserved in already existing maps or furnished by Mellin's correspondents. As a result, though often very picturesque, they tend to be cartographically inaccurate.

It was E. Chr. F. Knorre, the first astronomer observer of Tartu University, who first drew attention to the inaccuracies in

¹⁸ *Allgemeine Geographische Ephemeriden*, Vol. II, fasc. 5 (Weimar, November 1798), pp. 451—454; Vol. IX, fasc. 2 (February 1802), pp. 117—178; Vol. XVIII, fasc. 2 (October 1805), pp. 205—208; Vol. XXXIV, fasc. 1 (January 1811), pp. 80—82.

Mellin's maps. Carrying out observations of his own for the purpose of determining the geographical co-ordinates of the town, Knorre found that the parish church of Kanepi (Kanapae), placed by Mellin almost exactly due south of Tartu, lies in actual fact six versts to the east of the Tartu meridian, which for a distance of 40 versts gives an error of almost 9 degrees.¹⁹ There is evidence that Knorre actually intended to carry out the triangulation of Livonia after the publication of Mellin's atlas,²⁰ but was prevented by his death in 1810. However, a first step in this direction may be seen in the surveying work done in 1808 along the river Ema-jõgi by M. G. Paucker,²¹ then a mere student at the University, later a proficient astronomer and mathematician, who eventually became a corresponding Member of the Academy of Sciences. As we shall see, the triangulation of Livonia planned by Knorre was finally realized by Fr. G. Struve, who took up the post of astronomer observer of Tartu University in 1813.

Mellin himself was fully conscious of the defects in his work. In his preface he regrets that he has not succeeded in surmounting all the obstacles in his path, and requests his readers to regard his contribution as a pioneer effort which may prepare the way for a more perfect publication in the future. Unfortunately nobody after Mellin has proved capable of tackling this task, and as yet there is still no scientific atlas of Estonia.

IV How Mellin's Atlas Took Shape

Many of the facts concerning the manner in which Mellin's atlas finally took shape are still unclarified. This is true, first of all, of the stimulus which impelled him to undertake the task. Previous investigators have suggested that the decisive impetus was given him by the Crown Prince Paul, later known as Emperor Paul I. But a glance at the original sources will suffice to make clear that Paul's influence was only of a passing and accidental nature, and in point of fact Mellin received no help from him in the actual compilation of the atlas. More, in 1798 Mellin fell into disfavour with the Emperor because of his very maps, and it was

¹⁹ Central State History Archive of the Estonian S. S. R., Section 1185, List 1, Item 44, p. 63.

²⁰ Г. Левицкий: Астрономы Юрьевского университета с 1802 по 1894 год (Юрьев, 1899), p. 12.

²¹ Magnus Georg Paucker: Vermessung des Embachs, seines Laufes und seiner Profile, im Sommer des Jahres 1808. *Archiv für die Naturkunde Liv-, Ehst- und Kurlands*, First Series, Vol. I (Dorpat, 1856), pp. 367—426 (with a map of the river).

only thanks to the tutelage of influential personages that he escaped imprisonment. Since in the conditions of the autocratic regime Mellin himself was reduced to silence, this fact remained unknown to the general public. But Mellin has perpetuated it in his autobiography, likewise in two or three anonymous articles,²² from which we may deduce the following broad account of the course of his affairs.

In November, 1782, the Crown Prince returned from a long tour abroad via Riga and stayed there for a few days. He ordered General Berg, commander of the troops in Livonia, to give him a map showing the distribution of the Livonian Division. Mellin, who then served as Quartermaster of the Division, received a peremptory order to produce such a map at short notice. When he presented his work to Paul, he drew his attention to the fact that he could not vouch for the accuracy of the map, as the geography of Livonia had been little studied and he himself had been there too short a time to improve matters in this respect. Paul found it highly regrettable that Livonia, which was one of the most advanced provinces of the Empire, should have no topographically accurate map. Acknowledging Mellin's competence and skill in the field of cartography, Paul hinted that it was for him to supply the deficiency, and that in so doing he would simultaneously confer a great favour on his native country.

Mellin himself expressly states that he accepted the Crown Prince's proposal all the more readily because of his deep personal interest in this kind of work. Thus the royal will was not in itself the decisive factor which stimulated him to undertake an enterprise of so vast a scope. The main incentive must be sought in Mellin's own scientific pursuits. In his preface to the atlas he points out that his aim was to compile up-to-date maps of Estonia and Livonia which might be added (as supplements) to Hupel's "Topographical Reports". Friebe seems to have had much the same idea in mind when he notes, quite correctly, that the appearance of Mellin's atlas must be connected with the increasing demand for accurate maps resulting from the rapid pace of economic and cultural development at the time.²³

The most detailed maps of the Baltic provinces then available were those published by the Academy of Sciences in the seventies of the eighteenth century. A map of Estonia was issued in Latin

²² Höchstinteressante Anekdote, die Geographie von Lief- und Ehistland betreffend. *Allgemeine Geographische Ephemeriden*, Vol. XII, fasc. 5 (November 1803), pp. 624—627. — See also Kurze Nachricht, betreffend die neuere Geographie von Liv- und Ehistland. *Nordisches Archiv*, Vol. IV (Riga, 1803), pp. 178—184. — See also Beitrag zur Geschichte des Atlases von Lief- und Esthland vom Grafen Mellin. *Allgemeine Geographische Ephemeriden*, Vol. XXII, fasc. 4 (April 1807), pp. 491—494.

²³ W. Chr. Friebe, *op. cit.*, p. 3.

and Russian in 1770.²⁴ The same year saw the publication of a map, also in Latin and Russian, of the island of Saaremaa (Oesel).²⁵ A map of the government of Riga came off the press in 1772, based on the same two languages as its predecessors.²⁶

All of these maps were compiled at the suggestion of the great Russian scholar Mikhail Lomonosov by two members of the Department of Geography, Jacob Friedrich Schmidt and John Truscott. In actual fact they had been completed long before, but thanks to the opposition of G. F. Müller, a personal antagonist of Lomonosov, publication had been long deferred. They all abound in errors and in no case can they pretend to any reasonable degree of accuracy.

In 1783, by order of Catherine II, a new administrative division, known as the *Statthalterschaft* (vice-regency), was introduced in the Baltic provinces. This reform, and others connected with it, brought the system of administration in the Baltic countries nearer to that of the other parts of Russia and did much to strengthen the economic links that bound them to the hinterland. The local Baltic German reactionaries had no other course but to accept these reforms for the time being, although they secretly hoped for a return of the old order.

In accordance with the decree the one-time Baltic provinces were now reorganized as the governments of Riga and Tallinn, the former with nine, the latter with five subordinate districts; and as a result of this innovation all the existing maps became antiquated at one stroke.

The administrative and territorial redivision of the Baltic area was first reflected in a small map of the governments of Tallinn and Riga published by A. W. Hupel and O. F. von Pistohlkors.²⁷ But because of its reduced scale and general unreliability, this map also fell far short of the standard set by the rising demands of the time.

²⁴ Provincia Revaliensis sive Estlandia Quatuor Diocesibus contenta, cum Finitimis Insulis Dago, Worms. etc. Auctore J. F. Schmidio Acad. Petropol. Adjuncto. Impressa Petropoli 1770. Russian edition: Ревельская губерния, содержащая в себе Эстляндию, на четыре уезда разделенную с принадлежащими к ней островами Даго и Вормсом. Я. Ф. Шмит, 1770.

²⁵ Nova Descriptio Insulae Oesiliae ad Observationes Astronomicas et Mensuras Geometricas a Grischovio Anno 1753 institutas exacta. Comp. I. Truscott, 1770. Russian edition: Новая карта острова Езеля, сочиненная по астрономическим наблюдениям и геометрическим измерениям, учиненным в 1753 году Г. Гришовым, трудами И. Трускота, 1770.

²⁶ Tabula Geographica Gubernii Rigensis in suos circulos divisi. Auctore J. F. Schmidio. A. I. P. Adjuncto 1772. Russian edition: Карта географическая, представляющая Рижскую губернию, на четыре уезда разделенную, сочинял Акад. Наук адъюнкт Я. Ф. Шмидт, 1772.

²⁷ Darstellung der neuen auf Kaiserl. Befehl im Jahr 1783 errichteten Revalischen und Rigischen Statthalterschaften und ihrer neuen statthalterschaftlichen Vertheilungen der Kreise und Kirchspiele, nach Anleitung der neuen Hupel'schen Karte vom Jahr 1774. *Nordische Miscellaneen*, Vol. VIII.

Nor should another aspect of the problem be forgotten. The wars waged in the eighteenth century had created an imperious need for accurate maps. At the same time the situation in Europe was tense. The division of Poland was impending. Sweden was continually hatching schemes for recovering her lost provinces in the Baltic, on which the covetous gaze of Prussia was also turned.²⁸ The war with Turkey had seriously strained the relations between Russia and Great Britain. Thus urgent military considerations underlined the need for a set of new up-to-date maps of Livonia, which at that time was a frontier province of vital strategic importance (Courland not being annexed to Russia until 1795).

Mellin set himself the aim of making his maps of Livonia and Estonia as complete and accurate as possible. According to his initial plan the atlas was to consist of a title-page, a general map and special maps of each of the administrative districts of the provinces of Livonia and Estonia. The maps of the districts were to be drawn up in accordance with the administrative and territorial division then in force, which had come into being after the reform in 1783. In all there are fourteen district maps, four of which cover present Latvian territory, and ten present Estonian territory.

After the accession of Paul I, the administrative reforms introduced by Catherine II were rescinded. In a decree of May 1, 1797, Paul I permitted the Baltic provinces to return to their former status. This was a serious setback to the work on the atlas, since it involved considerable changes in the administrative and territorial division on which Mellin's arrangement had been based. As many of the maps had already been completed, it was no longer possible to alter the structure of the atlas. Accordingly Mellin decided to stick to his original plan, but to add a preface in which the corrections to be made in the administrative and territorial division are explained.

As the work on the atlas was drawing to an end, Mellin decided to include, by way of a supplement, the map of the early history of Livonia (up to 1562) published by Friebe in his history of the provinces of Livonia, Estonia and Courland.²⁹ He also contemplated adding Friebe's historical map of Livonia (for the period 1562—1710),³⁰ which, however, was never destined to appear in print.

²⁸ Я. Зутис, *op. cit.*, pp. 611—612.

²⁹ Livland nach der Eintheilung Heinrich des Letten und zu den Zeiten der Bischöffe u. Ordensmeister bis 1562. Entworfen von W. Chr. Friebe, gezeichnet von I. W. Krause, gestochen von F. Ramberg (Riga, 1792).

³⁰ W. Chr. Friebe, *op. cit.*, pp. 4—5.



Fig. 4. Johann Friedrich Hartknoch.

The publication of the atlas was undertaken by the bookseller Johann Friedrich Hartknoch (Fig. 4), whose enterprise was one of the largest in Northern Europe at that time.³¹ At first Hartknoch intended to have the maps engraved in St. Petersburg, but finding the fees of the local artists exorbitant, he had them engraved in Germany instead.

According to Mellin's original plan the special maps of Livonia were to be printed first, followed by those of Estonia. The early sheets appeared more or less in the sequence planned, but later on this order was not entirely adhered to. Many maps carry no indication of the dates of compilation and engraving, which might otherwise enable us to piece together an approximate picture of the general progress of the work. Unfortunately, most of the original drawings of the maps have been lost. But there is a sketch for the map of Estonia which still is preserved at Riga, in the library of the Academy of Sciences of the Latvian S. S. R.³² Some of Mellin's original drawings are now in keeping of the State Central Archive of Military History in Moscow.³³

The first map of all, that of the district of Riga, was published in 1791, and may have been engraved in the same year, or some-

³¹ A. Poelchau: *Der Verlag von Johann Friedrich Hartknoch, Buchhändler und Verleger. Mitau, 1762—1767, Riga, 1767—1804. Ein bibliographischer Versuch* (Riga, 1918).

³² *Karte von Estland von Ludwig August Graf Mellin* (114 × 280 cm), in the Library of the Academy of Sciences of the Latvian S. S. R., Riga. Some of Mellin's drawings, previously held in the Riga Municipal Library (map reference nos. 992, 994 and 995), were lost during the Second World War.

³³ Brouillons of the maps of Livonia and Estonia, by Count Mellin. The State Central Archive of Military History, Moscow, map reference no. 21347.

what earlier. Next came the maps of the districts of Cēsis, Valmiera, and Valga, the last of which was engraved in 1793. These were followed by the districts of Võru (year of publication unknown), Tartu (drafted and engraved in 1796) and Pärnu (drafted 1797, engraved 1798). By this time the drawings of the remaining district maps had already been completed. Tallinn, Rakvere and Paide were finished and sent to the engraver in 1796. But in 1798 only the districts of Kuressaare, Haapsalu and Tallinn were actually engraved. The last sheets, containing the districts of Paldiski, Rakvere and Paide were completed a few years later.

The first maps were received by the public very favourably. The Crown Prince Paul expressed his satisfaction with Mellin in a letter full of compliments, while Catherine II conveyed her congratulations in a personal note which was accompanied by a valuable present. A few years later, in May 1797, when Paul I made a short stay in Riga after his coronation, Mellin presented him with the sheets which had been completed in the meantime. Paul glanced through them with approval and insisted on the completion of the whole undertaking. On leaving Riga he issued a decree to present Mellin with an order of high distinction, but due to an error on the part of the Emperor's office it was sent instead to Count Münnich, who was then peacefully living on his estate at Luunja near Tartu and was very much surprised at being singled out for this honour by the Emperor.

Soon afterwards publication of the atlas was suspended. At the beginning of 1797 Paul I imposed a strict censorship on all kinds of printed matter. Hartknoch, the publisher, became involved in a sharp conflict with the censor of Riga and was arrested at the end of 1797 on a charge of disseminating subversive literature.³⁴ He managed to secure his release soon after, but in the spring of the following year he liquidated his business and left Russia for Leipzig, where the last maps of the atlas were published. That is why the name of Leipzig stands side by side on the title-page with that of Riga as the place of publication.

At the same time the work of engraving the Tallinn and Haapsalu sheets on copper continued. As Mellin was unable to obtain proof-sheets of the maps, a number of misleading errata remained uncorrected. In Mellin's opinion the Tallinn sheet came out worst and was a disgrace to the whole atlas.³⁵ Mellin wanted to have it re-engraved, but the publisher refused on the score of the heavy

³⁴ Geschichte der Gefangenschaft des Buchhändlers Hartknoch unter der Regierung Kayser Pauls I. Von ihm selbst erzählt. Historische Gemälde in Erzählungen merkwürdiger Begebenheiten aus dem Leben berühmter und berühmter Menschen, Vol. XI (Leipzig, 1803) pp. 1—41.

³⁵ Kurze Nachricht, betreffend die neuere Geographie von Liv- und Ehstland. *Nordisches Archiv*, Vol. IV (Riga, 1803), p. 183.

costs which he had incurred during the liquidation of his business in Riga.

Mellin himself was called upon to undergo many tribulations in connection with the atlas. In October, 1798, the Civil Governor of Livonia Ch. A. von Richter received a decree from St. Petersburg instructing him to arrest Mellin by command of Paul I and to have him tried by court martial. Mellin was accused of publishing ordinance maps of Estonia and Livonia in compiling which he had made criminal use of his previous connections with the General Staff, and of having the maps engraved abroad. The Governor, who had followed the compilation of the atlas from the very beginning and had himself occasionally lent a hand with the work, interceded for Mellin before the Emperor. At last Paul abrogated his order for Mellin's arrest and trial, but had all the drawings and other materials pertaining to the atlas sequestered and removed to St. Petersburg.

Shortly after Mellin was again summoned to appear before the Governor, who handed back to him his unfinished general map of Livonia with all its appurtenant materials and communicated to him the Emperor's order that he should complete the map with the greatest possible despatch. At first Mellin contemplated refusing, but warned by the Governor of the perilous consequences of evoking the Emperor's displeasure, he changed his mind and resumed work on the map. On completing it he was to deliver the map, together with all the appurtenant materials, to the Emperor in person. Mellin also had to sign a document in which he bound himself to gather together all the clichés and printed sheets that were scattered abroad and had them over to the authorities. But since communications with foreign countries were almost completely suspended by order of Paul himself Mellin was unable to keep his pledge, and later the matter was forgotten.

On December 9, 1798, Paul I issued a special decree requiring that all geographical maps should be submitted for examination to the Department of Geography of the Senate and all topographical and other maps of military importance to the Imperial Depot of Maps on the General Staff. By the same decree no maps could be conveyed across the frontiers of the state, while all the "geographical maps of the government of Riga" (i.e. those in Mellin's atlas), were to be delivered, along with their copper plates, to the Depot of Maps.³⁶ In other words Mellin was virtually forbidden to sell his maps of the Atlas of Livonia, all the sheets of the atlas that were in the bookshops were forthwith confiscated, and private in-

³⁶ К. А. Салищев: Основы картоведения. Часть историческая и картографические материалы (Moscow, 1948), p. 163.

dividuals were called upon to deliver up all the maps in their possession by March 1, 1799.³⁷

The ban on the atlas held up the undertaking for many years and it was not until after the death of Paul I that publication of the overdue instalments could be resumed. At Mellin's request, Alexander I issued a special decree of Feb. 13, 1802, allowing the author to put up his geographical and topographical maps of Livonia and Estonia for sale once again, and the last obstacles to the full publication of the atlas were removed. The sheets for Kuresaare and Haapsalu were printed in 1802, Tallinn, Paldiski and Paide appeared in 1803, and Rakvere, the last instalment of all, came off the press in November, 1803.³⁸

Remains the question of the date of publication of the general map, the title-page and the preface. All of these were finished by 1798, though they were actually published much later. The general map was probably printed after the title-page. This has led many authors to regard it as something extraneous to the atlas proper and to ascribe to Friebe's historical maps the function of the general map. The facts, however, speak differently. Mellin himself, after the publication of Friebe's first historical map in 1794, repeatedly deplored the absence of the general map, and continued to do so as late as 1803.³⁹ Moreover, the fact that Mellin's own general map of Livonia and Estonia was intended from the very first as a constituent part of the work is corroborated by its format, which is identical with that of the other parts of the atlas.

Mellin returned the Tallinn sheet to the engraver at the same time as the title-page and the general map. The date marked on the vignette after the engraver's name is 1809, but it was probably not printed before 1810. Thus the map of the Tallinn district exists in two variants which differ in numerous details and in the vignettes they carry. At all events, the title-page, general map and preface had all appeared in print by the end of 1810,⁴⁰ and with them the compilation and publication of the atlas, which altogether had occupied twenty-eight years (1782—1810), came to an end.

Mellin did not lose his interest in the mapping of his native country after the publication of the complete atlas. Thus we know that he made efforts to found a centre where all the original draw-

³⁷ K. G. Sonntag: Die Polizei für Livland von der ältesten Zeit bis 1820. Erste Hälfte (Riga, 1821), p. 88.

³⁸ *Allgemeine Geographische Ephemeriden*, Vol. XII, fasc. 5 (November 1803), p. 627.

³⁹ Kurze Nachricht, betreffend die neuere Geographie von Liv- und Ehstland. *Nordisches Archiv*, Vol. IV (Riga, 1803), p. 184. See also Briefe von Gelehrten etc. an Morgenstern, Vol. III, pp. 345—348 (a letter from L. A. Mellin to Prof. K. Morgenstern). MS in the Library of Tartu University.

⁴⁰ Atlas von Lief- und Ehstland, oder von den beiden Gouvernemen-ten Lief- und Ehstland, und der Provinz Oesel. *Allgemeine Geographische Ephemeriden*, Vol. XXXIV, fasc. 1 (January 1811), pp. 80—82.

ings of estate maps should be collected and preserved. Plans of this type had been drafted for the majority of the estates in Livonia in connection with the implementation of the peasant law of 1804. But although Mellin submitted his proposal to the Governor-General, the local authorities, the provincial assembly of Livonia and other administrative bodies;⁴¹ he was unable to secure a sympathetic hearing and the project was never realized.

V The Importance of the Atlas

As map-maker Mellin unswervingly adhered to the traditions of eighteenth-century cartography. He had no triangulation data at his disposal. That is why his maps, like those of his predecessors in the eighteenth century, have the drawback of lacking an accurate geodetical foundation. In spite of this, the publication of Mellin's atlas marked an essential step forward in the history of geography in the Baltic countries, since it splendidly summed up the cartographical work carried out in the eighteenth century. In the "Atlas of Livonia" abundant topographical materials were presented with unprecedented attention to detail. Right up to the forties of the nineteenth century Mellin's maps remained the chief cartographical reference for the Baltic provinces, and they were extensively used by Bienenstamm, whose work may be regarded as the first purely geographical study of Estonia and Latvia.⁴²

Owing to their low degree of accuracy Mellin's maps, of course, fell far short of the standard required in true topographical maps. That is why even before the completion of the atlas the Depot of Maps of the General Staff undertook a topographical survey of Estonia, which was carried out between 1802 and 1811.⁴³ As a result, a detailed, reasonably accurate and artistically produced map on a scale of 1 : 42 000 came into being, though as it was strictly designed for military purposes it did not become generally known. But this map, too, had no true geodetical basis.

Mellin's atlas represents the supreme achievement of pre-triangulation cartography in the Baltic area, while at the same time it called attention to the imperative need for a radical change in method. The famous Russian geodesist Karl Tenner, who was also born in Estonia, was the first to apply triangulation in practice. In

⁴¹ L. A. Mellin: *Noch einiges über die Bauernangelegenheiten in Lief-land*, pp. 107—109.

⁴² H. Bienenstamm: *Geographischer Abriss der drei deutschen Ostsee-Provinzen Russlands, oder der Gouvernements Ehst-, Liv- und Kurlands* (Riga, 1826).

⁴³ E. Varep: *Topograafilisest mõõdistamisest Eestis aastail 1802—1811*. Summary: *The Topographic Survey of Estonia in 1802—1811*. *Tartu Riikliku Ülikooli Toimetised*, fasc. 128 (Tartu, 1962), pp. 164—175.

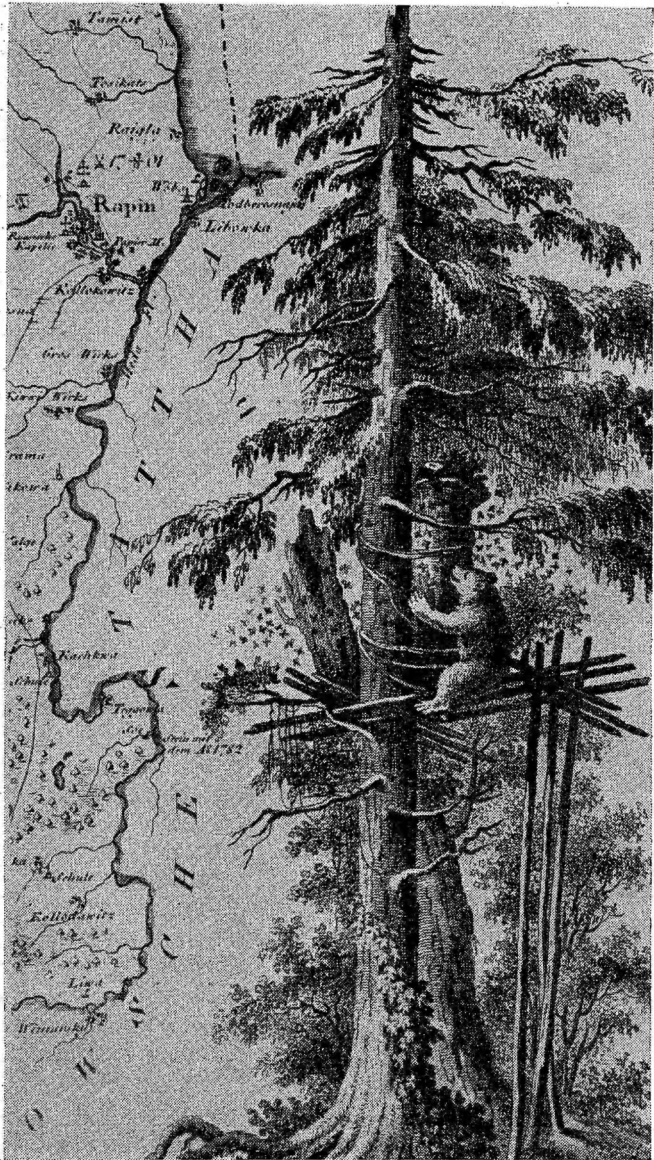


Fig. 5. Bear stealing honey. Vignette of ethnographical interest in Mellin's atlas (map of Vöru district).

1809—1811 he laid out a network of triangles stretching from St. Petersburg to Narva.⁴⁴ Tenner planned to extend his survey along the southern coast of the Gulf of Finland right up to Tallinn, but was interrupted by the war of 1812. In the years 1816—1819 F. G. W. Struve, the future professor of Tartu University and world-famous astronomer, carried out the triangulation of Livonia. This was done so accurately that it was later extended and led to an undertaking of world-wide importance — the measurement of an arc of meridian, covering 25°20' of latitude, from the mouth of the Danube to the Arctic Ocean.

Struve's survey of Livonia was carried out at the request of the Livonian Society of Public Utility and Economy, which was anxious to obtain an accurate map of the province. Since Mellin was not only an active member of the Society, but also deeply interested in the cartography of the region, we might suspect him of being the real initiator of this undertaking. Unfortunately, the files of the Society, which are preserved in the State Central Historical Archive of the Estonian S. S. R., cast no light on the question, though there is reason to assume that the initiative did not come from Struve himself. We know, however, that in submitting to the Society his project for the survey, Struve analysed the defects of Mellin's atlas in great detail.

Struve's triangulation provided the geodetical basis for the compilation of a new atlas of Livonia. This atlas, however, failed to materialize and the first immediate fruits of the undertaking took the form of a special map of Livonia by C. G. Rucker, which was published by the Livonian Society of Public Utility and Economy in 1839.⁴⁵ All the existing maps of estates were drawn upon in compiling the map, which was drafted on a scale of 1 : 184,275. Its fundamental accuracy was acknowledged by Struve himself, Karl Ernst von Baer and many other scientists. A few years later, in 1844, a map of Estonia by J. H. Schmidt was published as a companion-piece to the map by Rucker.⁴⁶ Unfortunately, however, it was mainly based on data obtained from surveyors, and proved to be far less reliable than its predecessor, while in finish and artistry it also left much to be desired.

⁴⁴ Г. А. Желнин: Развитие основных астрономо-геодезических работ на территории Эстонской ССР в период 1811—1940 гг. *Eesti NSV Teaduste Akadeemia Toimetised*, Vol. II, fasc. 1 (Tallinn, 1953), p. 71.

⁴⁵ Specialkarte von Livland in 6 Blättern. Bearbeitet und herausgegeben auf Veranstaltung der Livländischen Gemeinnützigen und Ökonomischen Societät; nach Struves astronomisch-trigonometrischer Vermessung gezeichnet von C. G. Rucker; gestochen im Topographischen Depot des Kaiserlichen Generalstabes, 1839. — See also E. Varep: C. G. Ruckeri Liivimaa spetsiaalkaardist 1839. aastal. Zusammenfassung: C. G. Ruckers «Specialkarte von Livland 1839» (Tallinn, 1957).

⁴⁶ J. H. Schmidt: Generalcharte von Ehstland, in 2 Blättern. Mit Unterstützung des Vereins der Merinozucht zu Orrenhoff. 1844.

Today Mellin's atlas is of historical interest only, but as such it remains a unique and invaluable source of reference covering a wide variety of fields. It is of great importance to naturalists, since the maps enable them to follow such natural processes as changes in the contours of the shores and coasts; the merging of islands with the mainland as a result of the uplift of the surface, the paludification of lakes, changes in the course of rivers, etc. It is also a mine of information for the local history and historical geography of Estonia, particularly as regards the towns, villages and other populated centres, for the maps give a very complete and exact picture of the settlements and roads of the time. Many villages and farmsteads that were later annexed to the baronial estates are separately marked. The sheets are dotted with the tenant holdings and wayside inns so characteristic of the period. Nor has the author overlooked the manufactories, winter roads and tracks, and many other items indicative of the process of settlement that was going on at that time. Lastly the atlas is a valuable source of material for students of toponymics, containing, as it does, about 7100 Estonian and a large number of Latvian place-names that were in use at the end of the eighteenth century.

*

In his time Count Mellin was an outstanding personality with far broader views than the majority of his contemporaries. He was friendly-minded to the Estonian people and confidently believed in the abilities of the native population. These qualities prompt us to regard with enhanced respect both his indefatigable social activities and his substantial achievements in the field of science.

L. A. MELLINI «LIIVIMAA ATLASEST»

E. Varep.

Resümee

L. A. Mellini «Liivimaa atlas» on silmapaistvamaid saavutusi Baltimaade teaduslikul uurimisel XVIII sajandil. Selle koostamisel töötas L. A. Mellin, kes on võrsunud vene sõjaväe kartograafide koolkonnast, alates 1782. aastast mitmekümne aasta vältel. Atlas valmis põhjoontes 1798. aastaks, kuid keelustati Paul I käsul. Atlase väljaandmise jätkamine sai võimalikuks alles 1802. aastal, kaardistiku viimased osad ilmusid alles 1810. aastal.

L. A. Mellini atlas on suure väärtusega ajaloolis-geograafiliseks allikaks Balti vabariikide kohta. L. A. Mellini kaardid võimaldavad jälgida maismaa juurdekasvu Eesti rannikuil, saarte muutumist

poolsaarteks, jõgede voolusuuna muutumist, järvede soostumist ning muid looduslikke protsesse. Eriti üksikasjalikult on L. A. Mellini kaartidel kujutatud asulastik ja teestik. Kaartidele on kantud ka paljud linnused, lahingupaigad, kalmed ning muud muistised. Atlase kaartidel leidub Eesti alalt u. 7100 kohanime, millele lisandub suur hulk kohanimesid Läti alalt.

L. A. Mellin väärib hindamist ka ühiskonnategelasena, kes mõistis talurahva olukorra parandamise vajadust ning võimalust mööda sellele kaasa aitas. Eestlastesse, kes sel ajal olid pärisorjad, suhtus ta lugupidamisega, väljendades oma kirjutistes kindlat usku eesti rahva loovatesse jõududesse.

ОБ «АТЛАСЕ ЛИФЛЯНДИИ» Л. А. МЕЛЛИНА

Э. Варен

Резюме

«Атлас Лифляндии» Л. А. Меллина является одним из выдающихся достижений научного исследования Прибалтики в XVIII веке. Над его составлением Л. А. Меллин, представитель школы русских военных картографов, работал, начиная с 1782 года, несколько десятилетий. Атлас в основных чертах был закончен к 1798 году, но по приказу Павла I его издание запретили. Продолжение издания атласа оказалось возможным в 1802 году. Последние части атласа были напечатаны лишь в 1810 году.

Атлас Л. А. Меллина является ценным историко-географическим источником по Прибалтийским республикам. Карты Л. А. Меллина дают возможность следить за приростом суши на берегах Эстонии, превращением островов в полуострова, изменением направления стока рек, заболачиванием озер и другими природными процессами. Особенно детально на картах Л. А. Меллина изображены поселения и дороги. На карты нанесены также многие городища и места сражений, курганы и другие древности. На картах атласа приблизительно 7100 местных названий территории Эстонии, к которым прибавляется большое количество местных названий Латвии.

Л. А. Меллин заслуживает упоминания и как общественный деятель, понимавший необходимость улучшения положения крестьянства и старавшийся со своей стороны по возможности способствовать этому. Он относился с уважением к эстонцам, которые в то время были крепостными, и выражал в своих работах глубокую веру в созидательные силы эстонского народа.

DATA ON KAMCHATKA GEYSERS

A. Raik

The Geysers Valley in the east of the peninsula of Kamchatka about 15 km from the coast of Kronok Bay is the only place in the Soviet Union and one of the few areas on the globe where a most interesting natural phenomenon occurs: hot water springs — geysers — periodically erupt there. The area being wild and difficult of access, the geysers were discovered only in 1941 by T. I. Ustinova, a geologist, and up to a few years ago little was known about them.¹

The author was engaged in research into the regime of geysers in the Geysers Valley Sept. 7—11, 1960, when an expedition of young scientists from Soviet Estonia explored the Kamchatka geysers. The scientific results of the exploration are published in detail in the collected works of the expedition. Besides the investigation of the geology of the valley² interesting material was obtained on the regime of the geysers,³ the geysersites⁴ and the vegetation surrounding hot water springs and geysers,⁵ as well as on the algal flora of the Geysers Valley.⁶

The Geysers Valley lies in the eastern volcanic region of Kam-

¹ Т. И. Устинова: Гейзеры на Камчатке. *Известия Всесоюзного географического общества*, Vol. 78, No 4, 1946, pp. 393—402. — С. И. Набоко: Гейзеры Камчатки. *Труды лаборатории вулканологии*, Vol. 8, 1954. — Т. И. Устинова: Камчатские гейзеры (Москва, 1955).

² А. В. Раукас: О геологии долины реки Гейзерной. Summary: On the Geology of the Geysers Valley. *Исследование природы Дальнего Востока* (Tallinn, 1963), pp. 21—28.

³ А. А. Райк: О режиме гейзеров Камчатки. Summary: On the Regime of Kamchatka Geysers. *Ibid.*, pp. 39—95.

⁴ Каарель К. Орвику и А. В. Раукас: Гейзеритовые отложения в долине реки Гейзерной. Summary: Geysersites in the Geysers Valley, Kamchatka. *Ibid.*, pp. 96—111.

⁵ Х. Х. Трасс: О растительности окрестностей горячих ключей и гейзеров долины реки Гейзерной полуострова Камчатки. Summary: On the Vegetation around Hot Water Springs and Geysers of Geysers Valley, Kamchatka. *Ibid.*, pp. 112—146.

⁶ Э. Г. Кукк: Заметки о флоре водорослей долины реки Гейзерной. Summary: On the Algal Flora of the Geysers Valley. *Ibid.*, pp. 147—159.

chatka. The slopes of the Geyser Valley are about 1000 m. above sea level, its width in the lower reaches 3 km, and its depth is about 400 m. The slopes of the valley are steep (mostly 20–40°), in some places terrace-like. The Geyser Valley is connected with a belt of tectonic dislocations running in the NE–SW direction.

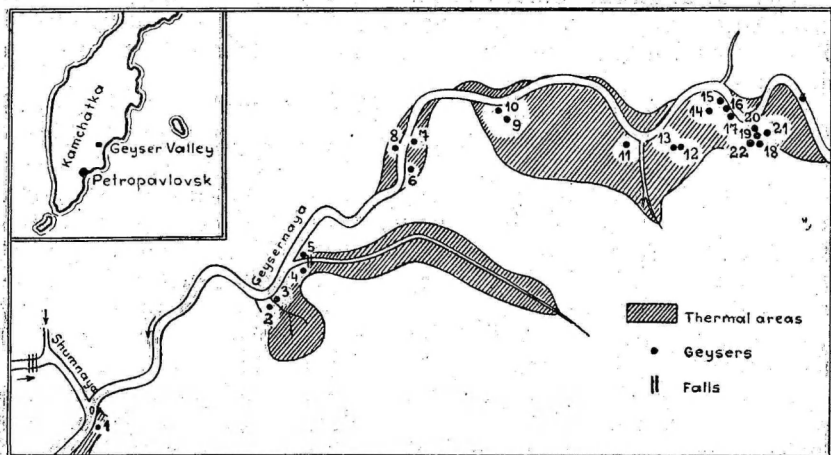


Figure 1. Location of the geysers and thermal areas in the Geyser Valley (after T. I. Ustinova, supplemented). 1. The Prime, 2. The Trio, 3. The Neighbour, 4. The Steam, 5. The Holed, 6. The Rocky, 7. The Cone, 8. The Big Stove, 9. The Big, 10. The Little, 11. The Slit, 12. The Fountain, 13. The New Fountain, 14. The Giant, 15. The Pearly, 16. The Lower Slit, 17. The Horizontal, 18. The Upper Dwarf, 19. The Central Dwarf, 20. The Lower Dwarf, 21. The Left Dwarf, 22. The Right Dwarf.

Along the bottom of the valley flows the Geysernaya, a tributary of the Shumnaya. Its waters are hot and rapid. The neighbourhood of the Geysernaya and the Vodopadnaya brook is a region of thermal areas, geysers and other geothermal activity (hot and spouting springs, mud craters, etc.). The geysers, except one (the "Big Stove"), are located on the left bank of the Geysernaya, several of them on the edge of the water (Fig. 1).

The following data on the geology of the Geyser Valley are presented after A. Raukas.⁷ Greenish-grey or bluish-grey tuffs, tuff breccias and tuffites of mixed (andesite and dacite) composition are the oldest rocks exposed in the valley. White pumice-like tuffites occur more rarely. Tuffs usually lie more or less horizontally or lean to the NE, N or SW with an inclination of 5 to 20°. The above-described bedding is often confused by faults pointing to the north or north-east (azimuths 350° or 20–30°). Most geysers and hot water springs are connected with such fault lines.⁸ The thick-

⁷ A. В. Раукас, *op. cit.* [see footnote 2 above].

⁸ Т. И. Устинова, Камчатские гейзеры [see footnote 1 above].

ness of tuff complexes can be estimated to be up to 400 metres. Mottled, well stratified sandstones with their elements pointing NE $55^{\circ} < 5^{\circ}$ lie on the tuffs, their depth attaining about 150 m. The youngest rocks in the valley are violet rhyolites and rhyolite porphyries of fluidal or spherulite structure.

Clays of different colours (white, yellowish, red, bluish, violet), originating from strongly weathered rocks under the influence of hot gases and highly mineralized water, is extensively exposed in the valley.

Geyselite — the precipitation of thermal water — is spread around almost every geyser and many spouting springs. An extensive geyselite tongue originates from the "Trio".

Both the "Pearly" and the "Sugary", a big spouting spring, owe their names to this geyselite. In general the thickness of Kamchatka geyselite is insignificant, but it differs very much in colour and its surface structure is highly variable. The morphogenetic classification of the surface structure of geyselite has been presented by K. Orviku and A. Raukas, who have also published some data on the spectral and chemical analysis of geyselite.⁹

By the time of the expedition nine years had passed since the last detailed research into the regime of the geysers. Therefore, the aim was set to observe all the geysers, for at least a short period of time, in order to define the most important changes in their regime. Regular observations of certain geysers were carried out in order to obtain information on the variations in their regimes and on the interrelations between the geysers themselves. For the first time in an investigation of the Kamchatka geysers observations were made round the clock.

Time-studies were carried out on the full regime cycles of 22 geysers and on several spouting springs. It was impossible to ascertain whether two geysers had stopped functioning or whether their cycle had been considerably prolonged.

Comprehensive data on the geysers are given in Table 2, where the geysers are presented in the order of their location along the banks of the Geysernaya up to its mouth. The most important data published in literature up to now have been summed up in the table according to the years of observation. The sources of these data are also indicated.

As may be seen from Table 2, the geysers in Kamchatka differ greatly. The diameter and depth of the gryphon of the "Giant" and the "Big" attain 3 m; those of the tiny geysers being more than 10 times smaller. The "Giant" erupts a jet up to a height of 40 m. (column of steam rising to 300—400 m.), the spouting of some other geysers does not exceed 1 m. The frequency of eruption of the "Giant", the "Pearly" and the "Lower Dwarf" is barely six times every 24 hours, while one of the biggest geysers, the

⁹ Каарель К. Орвику и А. В. Раукас, *op. cit.* [see footnote 4

"Fountain", erupts on an average four times an hour. The "Right Dwarf," one of a group of dwarf geysers studied for the first time, has the greatest frequency of eruption (the average to 13 observed cycles is 7 min. 17 sec.). It is an interesting fact that the "Right Dwarf," the only geyser with a more or less regular regime, has an eruption period which is longer than that of the rest (5 min. 27 sec. and 1 min. 50 sec. respectively). The difference in the duration of the eruptions is best illustrated by the geysers with the most spacious gryphons — the eruption of the "Big" lasts 15 min., that of the "Giant" lasts scarcely one minute, and it is still shorter in the case of several tiny geysers. It is interesting to point out that the water jets of the "Horizontal" and the "Big Stove" erupt horizontally across the Geysernaya river.

Great differences can be noticed in the character of the different stages in the activity of the geysers, as well as in the general trend of their cycles as a whole. In the case of the "Steam", one can speak of eruptions and rest periods, there being no sign of preparation for eruption. As for its name, the "Steam" was called so erroneously; it was established that contrary to earlier opinions, it does not erupt steam only, but also water like all the rest, although the water column is low and rare. The misconception was due to the "Steam" being situated on a high slope and its activities being observed from a distance. In contrast to the "Steam" the cycle of the "Little" can be regarded as classically perfect. Data on the time-study of the "Little" are presented in Table 1.

As an interesting single stage the overflow of the "Horizontal" must be pointed out. In the cycles observed this began 21—28 min. before the eruption and single overflows followed with admirable regularity, especially preceding the eruption. Each single overflow lasted 15—30 sec. Data on the time-study of the overflow of the "Horizontal" preceding the eruption on Sept. 10, 1960 are presented below:

Beginnings of single overflows

11 h. 53 min. 40 sec.	12 " 06 " 10 sec.	12 " 14 " 10 sec.
11 " 55 " 55 "	12 " 07 " 15 "	12 " 15 " 10 "
11 " 58 " 30 "	12 " 08 " 05 "	12 " 16 " 05 "
12 " 00 " 35 "	12 " 09 " 05 "	12 " 17 " 05 "
12 " 01 " 50 "	12 h. 10 min. 10 "	12 " 18 " 05 "
12 " 02 " 45 "	12 " 11 " 10 "	12 " 19 " 05 "
12 " 03 " 55 "	12 " 12 " 10 "	12 " 20 " 05 "
12 " 05 " 05 "	12 " 13 " 10 "	12 " 20 " 20 "

[the eruption]

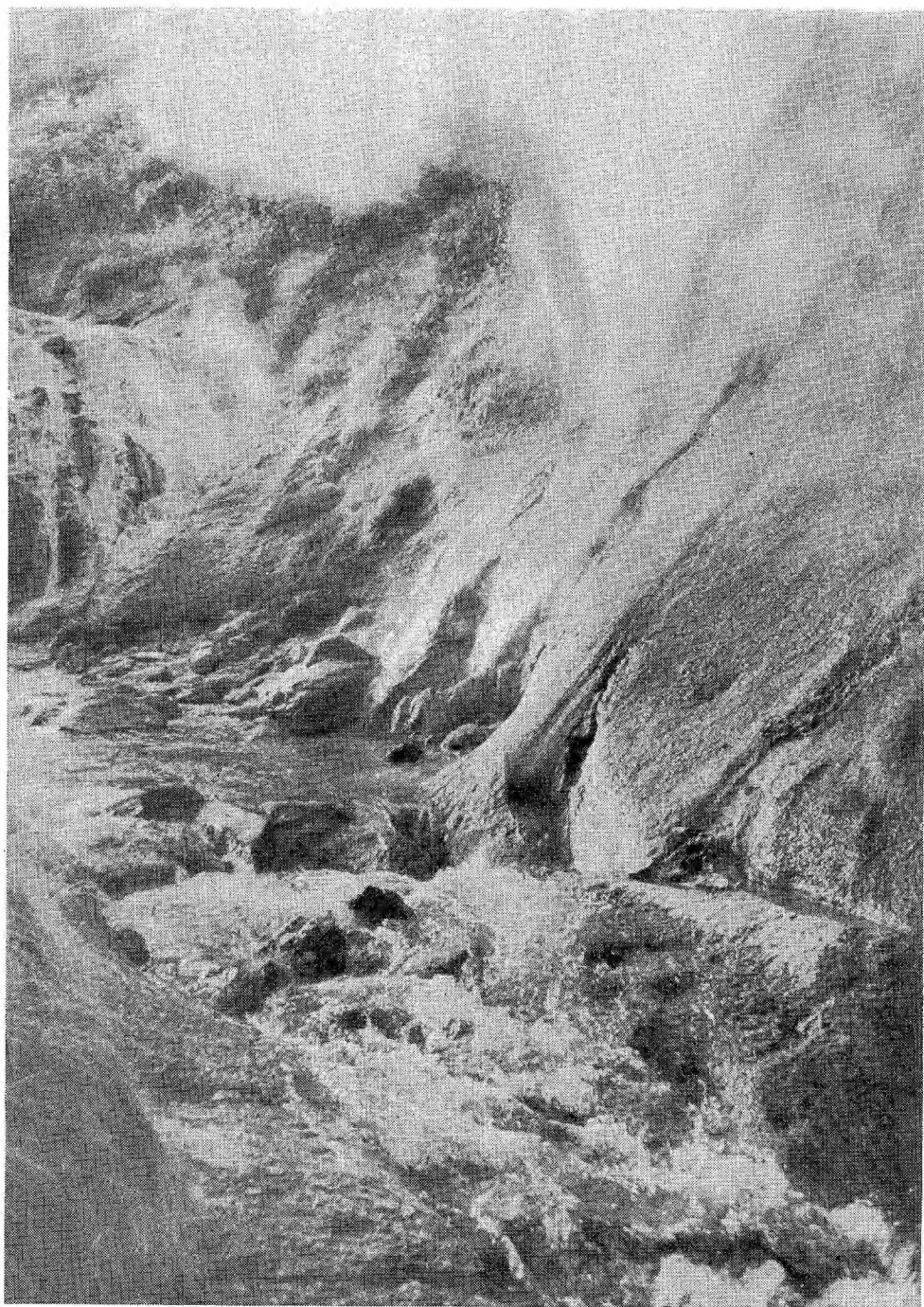
Perhaps we should add that the overflow of the "Horizontal" is one of the most regular phenomena in the regime of the Kamchatka geysers.

As regards the stability of the geyser regime, the following may be pointed out. On the basis of the differences noted during the short-term observations of 1941, 1945 and 1951, T. I. Ustinova

Table 1

Data on the time-study of the "Little" geyser
(based on observations September 8, 1960)

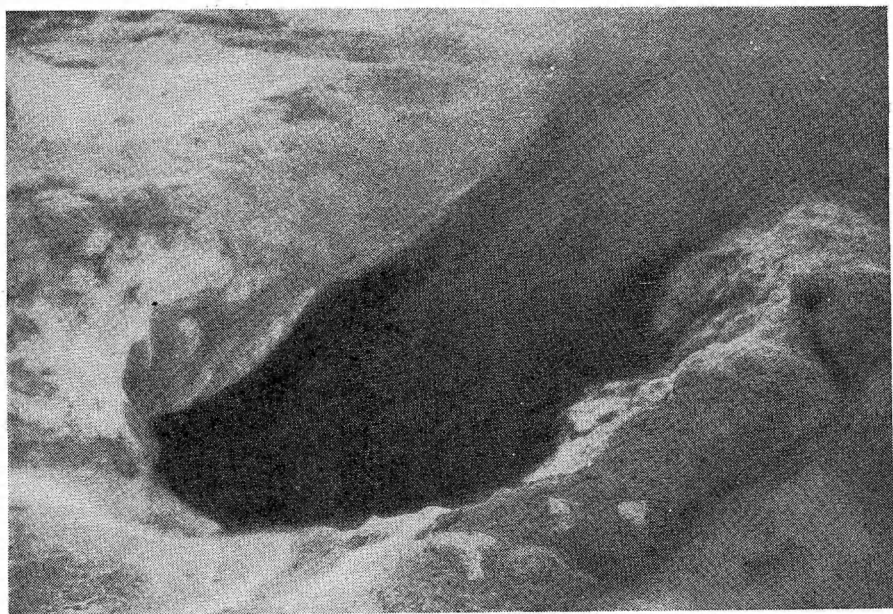
Stages of the action of the geyser	Time				
Appearance of water in the gryphon	18 h 24 min. 50 sec.	18 h 56 min. 30 sec.	19 h 28 min. 20 sec.	19 h 57 min. 05 sec.	
Filling of the gryphon	18 h 27 min. 00 sec.	18 h 58 min. 45 sec.	19 h 31 min. 00 sec.	19 h 59 min. 30 sec.	
Beginning of the overflow	18 h 28 min. 00 sec.	19 h 00 min. 45 sec.	19 h 32 min. 45 sec.	20 h 01 min. 35 sec.	
Intense boiling	18 h 31 min. 30 sec.	19 h 03 min. 55 sec.	19 h 35 min. 15 sec.	20 h 04 min. 10 sec.	
Preliminary eruptions	18 h 33 min. 50 sec.	19 h 05 min. 50 sec.	19 h 37 min. 55 sec.	20 h 07 min. 00 sec.	
Beginning of the eruption	18 h 34 min. 20 sec.	19 h 06 min. 10 sec.	19 h 38 min. 30 sec.	20 h 07 min. 20 sec.	
Beginning of the maximum eruption	18 h 34 min. 50 sec.	19 h 06 min. 40 sec.	19 h 38 min. 50 sec.	20 h 07 min. 40 sec.	
Cessation of the water eruption	18 h 40 min. 30 sec.	19 h 12 min. 00 sec.	19 h 44 min. 00 sec.	20 h 13 min. 30 sec.	
Cessation of the steam eruption	18 h 43 min. 10 sec.	19 h 14 min. 45 sec.	19 h 46 min. 40 sec.	20 h 16 min. 00 sec.	
Duration of the cycle	31 min. 50 sec.	32 min. 10 sec.	28 min. 50 sec.		



The R. Geysernaya.



View of the Geysir Valley.



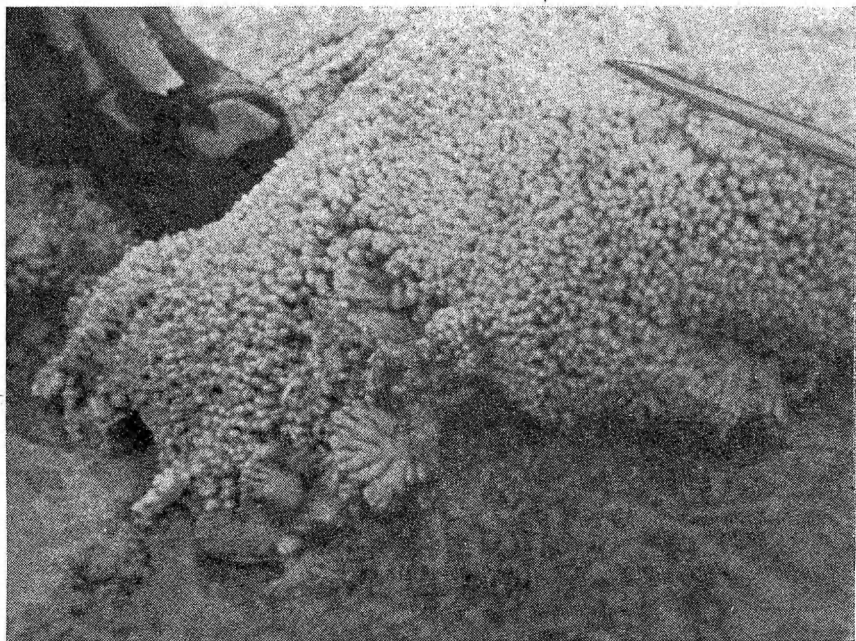
The gryphon of the "Giant."



The geyserite of the "Trio."



'Leafy' geysers (the "Giant" geyser).



'Coral' geysers (the "Sugary" spouting spring).

General survey of observation data

Table 2

Name of geyser				April - July 1941 (T. I. Ustinova, 1955)			August-September 1945 (T. I. Ustinova, 1955)			September 1951 (T. I. Ustinova, 1955)			August 1951 (S. I. Naboko, 1954)				September 1960			
	Breadth of gryphon (cm)	Depth of gryphon (cm)	Height of water column (m)	Number of cycles observed	Av. duration of cycle	Duration of eruption	Number of cycles observed	Av. duration of cycle	Duration of eruption	Number of observed cycle	Av. duration of cycle	Duration of eruption	Number of cycles observed	Av. duration of cycle	Extreme duration of cycle	Duration of eruption	Number of cycles observed	Av. duration of cycle	Extreme duration of cycle	Duration of eruption
1. Prime	130 × 75	150	20	6	0.45.30	2 min.	4	1:05.00	2 min.	1	2:18.00	2min.					0	2:30.00		
2. Trio	35 × 35 80 × 70 110 × 45	95 75 50	2 20* 6*				1	2:33.00	8 min.			8 min.					2	2:25.45	2:29.00 2:22.30	8 min.
3. Neighbour	100 × 50		5				7	0:07.26									10	0:19.38	0:55.00 0:07.00	1.15
4. Steam	40 × 40		1,5				1	0:50.00	1 min.								1	1:17.10		2 min.
5. Holed	105 × 50	115	1,5						2 min.			2 min.					8	0:37.11	0:38.00 0:35.00	5 min.
6. Rocky	60 × 20									1	0:50.00	2,5					0	2:30.00		
7. Cone	35 × 25		1				2	0:20.00	2 min.	3	0:18.07	2 min.	?	0:10.00	2 min.		6	0:22.07	0:22.40 0:21.35	1.35
8. Big Stove	100 × 55		8*				4	0:09.30	3 min.	1	0:08.14	3.40	?	?	0:08.00 0:06.00	2 min.	12	0:09.32	0:10.20 0:08.35	2.30
9. Big	310 × 180	300	45	1	1:47.00	6 min.	4	1:37.00	6 min.	2	1:27.15	6 min.	14	1:35.00	1:48.00 1:28.00	14 min.	24	1:27.54	1:32.40 1:20.30	15 min.
10. Little	250 × 150		17*	7	0:31.30	6 min.	12	0:32.20	5.15	3	0:31.06	5,55	50	0:31,26	0:36.26 0:27.00	5,30	56	0:32.14	0:37.00 0:28.50	6 min.
11. Slit	110 × 25	110	3				7	0:38.00	1 min.	3	0:35.00	1.15					2	0:37.20	0:38.00 0:36.40	1.20
12. Fountain	50 × 50	80	20	9	0:15.30	3.10	5	0:15.30	2 min.	6	0:23.33	3.25	64	0:24.44	0:28.00 0:22.00	3 min.	44	0:16.01	0:20.20 0:10.40	3.10
13. New Fountain	25 × 25		5																	
14. Diant	300 × 150	300	40	1	2:52.00	2 min.				1	3:10.00	2 min.					15	3:11.00	3:48.00 2:16.00	2 min.
15. Pearly	100 × 80		15				2	5:25.00	4 min.				6	4:15.25	5:00.30 3:48.30	4 min.	8	4:20.22	4:34.30 4:06.30	4 min.
16. Lower Slit	70 × 20		1*										11	0:58.16	1:07.30 0:45.00		21	0:29.54	0:36.25 0:25.25	2.50
17. Horizontal	100 × 50 40 × 10		12*										6	1:38.00	1:42.00 1:34.00	0,40	6	1:33.23	1:38.35 1:27.40	1 min.
18. Upper Dwarf	30 × 15		2										?	?	0:16.00		41	0:14.53	0:16.00 0:13.55	0.35
19. Central Dwarf	30 × 20		3*										23	0.30.17	0:35.00 0:27.00		11	0:53.0)	0:59.35 0:47.40	1.20
20. Lower Dwarf	40 × 40	50	3*														1	4:02:15		12 min.
21. Left Dwarf	20 × 20		1.2*														56	0:09.09	0:10.45 0:07.10	0.45
22. Right Dwarf	20 × 08		1*														13	0:07.7	0:09.10 0:06.25	5.30

* Horizontal reach of jet

drew conclusions on the changes observed in the regime of several geysers.¹⁰ In 1960, observations of somewhat longer duration showed that the sharp differences in the duration of the cycle of the majority of geysers that had served as the basis for drawing conclusions about changes in the regime, may last only a few days, or even hours, and cannot be said to affect the characteristic changes in the geyser regime. But to draw more definite conclusions it would be necessary to collect comparative data during a series of longer observations.

Judging by the scanty observation data we possess, it is evident that the cycles of some geysers have become considerably longer. In some cases, however, the cycle seems to have become shorter. Consequently, the changes are controversial and they have probably been caused by changes in the structure of the geyser canal, and not by changes in the thermal potential of the basin or general feeding conditions.

*

One of the most interesting research problems is that of the interconnections existing between different geysers.

The mutual dependence between two of the geysers situated close to each other, the "Fountain" and the "New Fountain," is most conspicuous. It must be remembered that the "Fountain" is one of the most regular geysers in Kamchatka. It erupts a regular jet, free from steam, up to a height of 15 metres. It is the most active of the great geysers, erupting 3 to 5 times an hour, whereas the eruption lasts from 3 min. to 3 min. 20 sec. One peculiarity of this geyser is the so-called post-eruption, taking place about 1 min. 20. sec. after the end of the eruption and mostly lasting 13 to 17 sec. During that period the water jet hidden in steam goes up to a height of 5 metres. A characteristic feature of the "New Fountain" is its constant eruption. The height of its jet is 4 to 5 m., being interrupted only by one external factor — the "Fountain," because the water cooled down in the eruption column of the latter falls into the gryphon of the "New Fountain." In most cases the "New Fountain" resumes its eruptions immediately after the end of the eruption of the "Fountain," sometimes several minutes later, but before the next eruption of the "Fountain." Once, after a plentiful inflow of cooled water into the gryphon of the "New Fountain," the action of the latter stopped for more than one hundred minutes. Now changes appeared in the regime of the "Fountain" itself: the duration of the cycle became shorter, and the character of the preparatory phase also changed. Usually the eruption of the "Fountain" immediately followed the filling of the gryphon, which

¹⁰ Т. И. Устинова, Камчатские гейзеры [see footnote 1 above].

lasted for 1—2 sec., but in the case of the “New Fountain,” the eruption was preceded by boiling for about 20 sec.

Another interesting pair of geysers is the “Trio,” erupting at the same time out of three apertures at different angles (75°, 40°, 20°) and on different azimuths (5°, 350°, 305°), and the geyser the “Neighbour,” situated on the eastern bank of the brook flowing into the Geysernaya. Observations show that before the eruption of the “Trio” the cycle of the “Neighbour” becomes shorter, i.e. the eruptions occur more frequently. The duration of the eruption becomes longer, the water jet erupts at a greater angle and rises higher. As an example, data on the timing of the “Neighbour” on Sept. 9, 1960, preceding the eruption of the “Trio” at 12 h. 56 min. are presented:

Beginning of the eruption	Duration of the eruption	Duration of the cycle
12 h. 02 min. 45 sec.	45 sec.	
12 „ 19 „ 20 „	75 „	16 min. 35 sec.
12 „ 32 „ 30 „	75 „	13 „ 10 „
12 „ 44 „ 45 „	80 „	12 „ 15 „
12 „ 54 „ 15 „	85 „	9 „ 30 „
12 „ 56 „	— the eruption of the Trio	

The water jet of the first and the last of the above-mentioned eruptions reached a height of 4 m. at an angle of 50° and 5—6 m. at an angle of 80° respectively.

A connection between some geysers and more modest forms (spouting springs, etc.) of geothermal action can be distinguished. An interesting phenomenon may be observed in the geyserite plateau of the “Giant.” A constantly erupting spouting spring is situated at a distance of 12 metres from the gryphon of the “Giant” under azimuth 205°. At the time of the eruption of the “Giant” the gryphon of the spouting spring becomes dry and its action is stopped for 11—12 min. Then the gryphon is filled again and the eruption continues.

The fact that a numerous group of different and regularly erupting geysers are concentrated in a small area in Kamchatka makes it possible to expect that their more detailed investigation will yield valuable information on the peculiarities of the regime of geysers and will contribute to an elucidation of this extremely interesting phenomenon in general.

ANDMEID KAMTŠATKA GEISRITEST

A. Raik

Resümee

Käesolevas artiklis iseloomustatakse lühidalt ainsat paika Nõukogude Liidus, kus leidub geisreid — Geisrite orgu, mis asub Kamtšatka poolsaarel Kronoki lahe ranniku lähedal. Antakse ülevaade geisrite režiimi kõige iseloomulikumatest joontest, peamiselt andmetel, mis autor kogus töötades geisrite orus Eesti NSV noorte teadlaste ekspeditsiooni koosseisus 7.—11. sept. 1960. Üldse kronometreeriti 22 geisri režiimi, mõnel neist jälgiti tegevuse tähtsüklit esmakordselt. Juhitakse tähelepanu seostele lähestiku paiknevate geisrite režiimis. Koondtabelis esitatakse kokkuvõtte geisrite režiimi seniste kronometreerimiste andmetest.

НЕКОТОРЫЕ ДАННЫЕ О ГЕЙЗЕРАХ КАМЧАТКИ

A. Райк

Резюме

В настоящей статье коротко характеризуется единственный в Советском Союзе район, где встречаются гейзеры. Долина гейзеров расположена на Камчатском полуострове недалеко от побережья Кроноцкого залива. Дается обзор самых характерных черт режима гейзеров, в основном по данным, которые автор собрал, работая в составе экспедиции молодых ученых Эстонской ССР с 7 до 11 сентября 1960 г. в Долине гейзеров. Вообще был хронометрирован режим 22 гейзеров, у некоторых из них полный цикл деятельности наблюдался впервые. Обращается внимание на связи в режиме гейзеров, расположенных недалеко друг от друга. В сводной таблице приводятся данные разных авторов по хронометражу режима гейзеров.

THE GEOGRAPHY DEPARTMENT OF TARTU STATE UNIVERSITY

E. Varep

The Department of Geography at Tartu State University is one of those which was founded as an independent body in Soviet times. Since its refoundation in 1802, the University had, it is true, turned out geographers from time to time. But the numbers of students and lecturers working in this field were insignificant. Geography was taught as a kind of side-line to naturalists and economists, and scant opportunities were offered to specialists, for whom there was little or no demand.

During the Second World War and the Nazi occupation the University lost all of its lecturers in geography, and when studies were renewed in the autumn of 1945 it was necessary to build up an entirely new staff consisting mostly of young, inexperienced teachers. The number of students was small at the beginning, but has grown steadily from year to year. At the present time (as from January 1, 1964) it stands at 96 regular members of the student body, plus 31 correspondence students. To these should be added the 88 extramural students of geography who belong to the Teachers' Training College attached to the University. Up to 1961 the Department of Geography was integrated in the Faculty of Mathematics and Natural Sciences, but in that year the three departments of biology, geology and geography broke away to form the new Faculty of Biology and Geography.

The teaching staff of the Department has now 11 members. Four of these had already graduated from the University during the pre-war period, while the rest were trained by the Department itself in Soviet times. The subjects are shared as follows: 3 lecturers work in the field of physical geography, 1 in climatology, 1 in geodesy and cartography, 5 in economic geography, and 1 in geography teaching methods. Seven members of the staff already possess the degree of Cand. Sc. (Candidate of Science), and the remainder are preparing to take the degree in the immediate future. Special courses of lectures are read in various subsidiary

subjects by outside specialists and persons of wide practical experience. During the present academic years (1963/1964) no less than 15 lecturers of this type are working for the Department. There are 5 research studentships (of which one is extramural) for graduates preparing to take up scientific or teaching work, and a number of technical workers, of whom 3 have graduated from the Department.

Studies at the University are organised along the lines generally accepted in the Soviet Union, with, however, certain adjustments introduced in deference to local conditions. The full course lasts for a period of 5 years, at the end of which graduates become qualified secondary-school teachers of geography. However for those who specialise in some narrower discipline and do not qualify as teachers, the duration is extended to five and a half years. For extramural students the course is a year longer. The vast majority (ca 80%) of the students receive scholarships, and all who wish are housed in one of the student hostels during the period of their stay at the university.

In their first two years students of geography receive instruction in the general branches of natural science, including physics, chemistry, astronomy and higher mathematics. All students are required to pass examinations in the following subjects: general geography and an introductory course in economic geography, geodesy, cartography, general and historical geology, meteorology and climatology, general hydrography, the geography of soils, botanical geography and zoogeography. The courses in regional geography embrace a number of other obligatory disciplines, such as the physical geography of the world, the economic geography of foreign countries, the physical geography of the Soviet Union, the economic geography of the Soviet Union, and the physical and economic geography of the Estonian S.S.R. Other general compulsory subjects are methods of geographical research and the history of geography. Students training to become teachers also take special supplementary courses calculated to equip them with additional teaching qualifications, such as biology, foreign languages, or some similar subject. In the case of students who are training for scientific research work, these courses are replaced by some subject connected with their special line of studies. Specialised training takes place on a basis of individual instruction or in small groups, the subjects covered including physical geography, economic geography and climatology-hydrography. The language used in every case is Estonian, with the exception of a few courses which are read by guest lecturers from other universities. All the students learn foreign languages and enjoy extensive facilities for engaging in sports and physical training.

A prominent feature of the curriculum is the inclusion of a number of practical training courses. In the first two years these

continue for eight weeks during the summer, and the work is carried out under the direct supervision of the University staff. The subjects for the first year comprise geodesy, geology and geomorphology, meteorology and hydrography. The second year adds soil science, botany, economic geography and the complex study of landscapes. In the third and fourth years practical training is acquired in fields more closely related to the student's special subject and offers wider latitude for individual initiative. The work may now take place in research institutes or other outside establishments, and may assume the form of an assignment for independent geographical research. In the fifth year students training to become teachers have teaching practice lasting for the whole of one term, while those specialising on the theoretical side engage in practical research work. Altogether the advanced practical training of the three senior years lasts from 36 to 45 weeks, according to the student's special subject.

The object of the special training received by the senior year-groups is to prepare the students for their future professions. Thus those who specialise in physical geography are drawn into the complex study of the land resources, the mapping of soils, the investigation of rivers, lakes, fens and bogs, etc. Members of the group majoring in climatology and hydrography have their special training at meteorological and hydrological stations and observatories. Specialists in economic geography are harnessed in leading organs of economic administration and state planning and control.

Not infrequently the practical training courses carry facilities for extensive travel. Students participating in special or complex geographical expeditions have visited Kazakhstan, Lake Baikal and its hinterland, the Far East, the Atlantic Ocean (servicing weather stations installed on leading ships of the fishing fleet), etc. A group of students spent the summer of 1963 on board the research ship "Bataisk", which carried out investigations in the Arctic Ocean, the temperate and subtropical zones of the Atlantic, the Mediterranean and the Black Sea. Several students have acquired practical experience in scientific work at one or other of the leading research centres of the Soviet Union.

In addition to those included in the regular practical training courses, other excursions are arranged on an optional basis. In the first and second years of study these excursions are confined within the frontiers of Estonia. In the third year they visit the Kola Peninsula, and in the fourth the Caucasus or Central Asia. It is their function to supplement and reinforce the factual materials that have been assimilated by the student in a purely theoretical manner, and at the same time to impart a practical general knowledge of the natural features and economic and cultural achieve-

ments of other Soviet republics. Thus they provide a first-hand acquaintance with all the natural zones from the Arctic to the arid subtropical belt. As a rule all students of geography take part in these voluntary trips, unless they happen to be engaged in some more distant expedition. Not only are they of great educational value in themselves, but they have the additional advantage of being free of charge, all expenses being covered by the University exchequer.

The practical training courses also furnish the students with materials for their written papers and diploma theses, which as a general rule are based on some form of field research work. The diploma paper, which reflects the general level of the student's knowledge of his special subject on completing his course of studies at the University, is required to present new data and may be granted facilities for publication after acceptance. Two collections of students' articles have already been printed on the University rotary press. The scientific interests of the students are stimulated and directed by the Geography Study Circle operating within the framework of the Student Scientific Association of the University. The study circle organises multiple field activities, discussions, conferences, symposia, and other events of a similar character. It maintains permanent contact with a number of student scientific societies in other Soviet universities.

Hitherto 232 full-time students and 34 correspondent students of the Geography Department have graduated from the University. To these may be added 24 students of the Teachers' Training College, who have received their final diploma in geography. About 40% of the graduates in geography are employed as teachers in Estonian secondary schools, whilst the remainder are engaged in various branches of administrative, commercial or research work.

The scientific activities of the teaching staff have mainly centred round problems of the physical and economic geography of the Estonian S.S.R. The chief objects of research during recent years have been the complex study of the land resources. Territorial investigations in this field have dealt with the relief, soils, vegetation, hydrography and microclimate with an eye to seeking new ways and means of ensuring fuller and more rational utilisation of the land. Considerable attention has been devoted to the study of landscape types. Population surveys have been concerned not only with problems of regulating current tendencies in the interests of Socialist economy, but also with various aspects of historical development. As for the researches in local economic ties and relations, their principal aim has been to study the division into economic regions and to elucidate the most expedient patterns for the distribution of the fundamental productive units. All of these lines of inquiry have involved persistent collaboration with

leading Soviet scientific research centres and other universities or higher educational establishments. Outstanding results have been published from time to time in the following series: *Tartu Riikliku Ülikooli Toimetised, Geograafia-alaseid töid* [Transactions of the Tartu State University, Publications on Geography, Tartu]; *Eesti Geograafia Seltsi Aastaraamat* [Yearbook of the Estonian Geographical Society, Tallinn]; *Eesti Geograafia Seltsi Publikatsioonid* [Publications of the Estonian Geographical Society, Tallinn]; *Loodusuurijate Seltsi Aastaraamat* [Yearbook of the Naturalists' Society, Tartu]; *Eesti Loodus* ["Estonian Nature" — popular-scientific magazine of the Academy of Sciences of the Estonian S.S.R., Tartu], and elsewhere.

TARTU RIIKLIKU ÜLIKOOLI GEOGRAAFIAOSAKOND

E. Varep

Resümee

Geograafiaosakond rajati Tartu Riiklikus Ülikoolis pärast Suure Ismaasõja lõppu 1945. aastal. Praegu (seisuga 1. jaanuar 1964. a.) õpib osakonnas 96 statsionaarset ja 31 kaugõppe üliõpilast; neile lisandub 88 Kaugõppe Pedagoogilise Instituudi üliõpilast, kes on oma erialaks valinud geograafia. Osakonnas töötab praegu 11 õppejõudu, kes enamuses on noored, lõpetanud osakonna sõjajärgsel perioodil. Osakonna on lõpetanud 232 statsionaarset, 34 kaugõppe ning 24 Kaugõppe Pedagoogilise Instituudi geograafia eriala üliõpilast.

Geograafiaosakonna teadusliku töö põhilisteks suundadeks on Eesti NSV maafondi maastikuline uurimine, asulastiku tänapäeva olukorra selgitamine ning selle ümberkujundamise printsiipide väljatöötamine, samuti ka vabariigisiseste majanduslike sidemete ja tootlike jõudude ratsionaalse paigutuse uurimine ning vabariigi majanduslik rajoneerimine. Artiklile on lisatud osakonna õppejõudude poolt aastail 1960—1964 avaldatud 96-nimetuselise teaduslike tööde nimestik.

ГЕОГРАФИЧЕСКОЕ ОТДЕЛЕНИЕ ТАРТУСКОГО ГОСУДАРСТВЕННОГО УНИВЕРСИТЕТА

Резюме

Географическое отделение в Тартуском госуниверситете было основано после Великой Отечественной войны, в 1945 году. В настоящее время по состоянию на 1 января 1964 г.) на отделении учится 96 стационарных студентов и 31 заочных; к ним при-



The University building at 46, Vanemuse St., in which the Department of Geography is housed.



Students attending a lecture.



Their first steps in Geodesy.



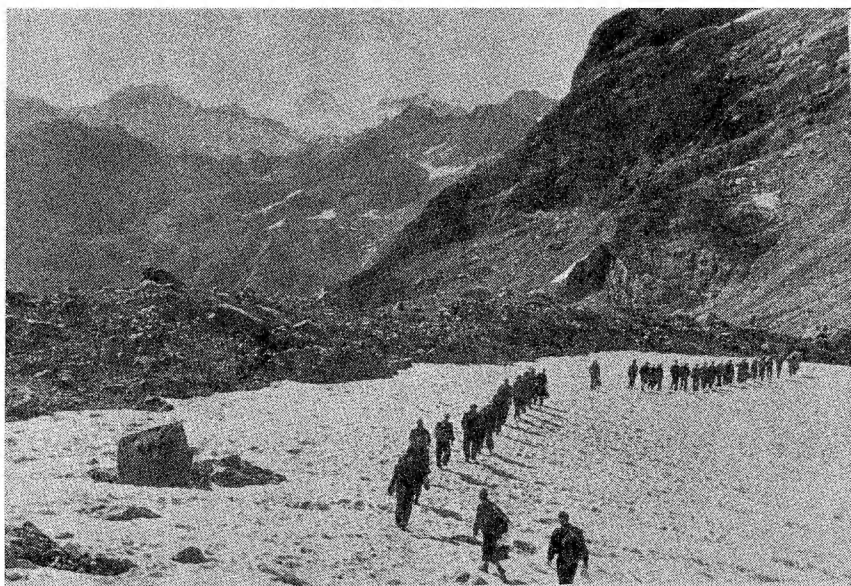
Practical training in Botany on the edge of the Glint.



On board the research training ship *Bataisk* in the North Atlantic.



Traversing a morass in Karelia.



Crossing a mountain pass in the Caucasus.

соединяются 88 студентов Заочного педагогического института при Тартуском университете, выбравших своей специальностью географию. На отделении географии работает 11 преподавателей, из которых большинство окончило это же отделение в послевоенный период. Отделение окончило 232 стационарных и 34 заочных студента университета, а также 24 студента по специальности география Заочного педагогического института.

Основными направлениями научной работы отделения являются ландшафтное исследование земельного фонда Эстонской ССР, выяснение нынешнего состояния поселения и выработка принципов его преобразования, а также исследование рационального размещения производительных сил, экономических связей и экономическое районирование республики. К статье прилагается список научных работ (96 названий), опубликованных преподавателями отделения за 1960—1964 годы.

BIBLIOGRAPHY

Publications of members of the Department since the preceding International Geographical Congress in 1960

Hang, Endel. Väike-Munamäe ja teiste Otepää kõrgustiku idaosa kõrgemate tippude kõrgusest [The height of Väike-Munamägi and other summits in the eastern part of the Otepää hill district]. *Eesti Loodus*, Vol. III No. 2 (Tartu, 1960), p. 103. With summaries in Russian and English.

Hang, Endel. Baikali järve sügavusest [On the depth of Lake Baikal]. *Eesti Loodus*, Vol. III, No. 6 (Tartu, 1960), pp. 374—375.

Hang, Endel (with V. Lepasepp). Haanja ja Otepää kõrgustiku geomorfoloogiast [The geomorphology of the Haanja and Otepää Uplands]. *Eesti NSV Teaduste Akadeemia Geoloogia Instituudi Uurimused* [Investigations of the Institute of Geology, Academy of Sciences of the Estonian S. S. R.], Vol. VII (Tallinn, 1961), pp. 69—76. In Estonian, with summaries in Russian and German.

Hang, Endel. NSV Liidu rannajoone pikkus [The length of the coastline of the U. S. S. R.]. *Eesti Loodus*, Vol. IV, No. 5 (Tartu, 1961), pp. 312—313.

Hang, Endel. Stanislav Vikentjevits Kalesnik [Stanislav Vikentyevich Kalesnik]. *Eesti Geograafia Seltsi Aastaraamat 1960/61* (Tallinn, 1962), pp. 337—345. With summaries in Russian and English.

Hang, Endel. P. S. Pallas [Double anniversary of P. S. Pallas]. *Eesti Loodus*, Vol. V, No. 1 (Tartu, 1962), pp. 36—37.

Hang, Endel (with A. Kaskneem). Miks lained tulevad randa? [Why is it that waves travel towards the shore?]. *Eesti Loodus*, Vol. VI, No. 1 (Tartu, 1963), pp. 63—64.

Hang, Endel (with A. Raik). Väino Lepasepp (1931—1963) [In memoir — Väino Lepasepp (1931—1963)]. *Eesti Loodus*, Vol. VI, No. 6 (Tartu, 1963), pp. 382—383.

Ilomets, Elmi. Geograafia kabinet ja õppevahendid [The school geography cabinet and its equipment]. Scientific Research Institute of Pedagogy of the Estonian S. S. R. (Tallinn, 1960), 39 pp.

Ilomets, Elmi. Geograafiaväljak koolis [The geography training ground in the school]. Tartu State University rotary press (Tartu, 1960), 52 pp.

Kala, Ilja. Kas tunnete Otepää kõrgustiku tähtsamaid mägesid? [Do you know the more important summits of the Otepää hills?]. *Eesti Loodus*, Vol. III, No. 4 (Tartu, 1960), pp. 233—239.

K a l a, I l j a. Trakai [Trakai — a beauty spot in the Lithuanian S. S. R.]. *Eesti Loodus*, Vol. V, No. 4 (Tartu, 1962), pp. 221—224.

K o n g o, A g u. Metoodiline juhend õppepraktika teostamiseks mullastiku-geograafia alal [Instructions for practical field training in the geography of soils]. Tartu State University rotary press (Tartu, 1960), 35 pp.

K o n g o, A g u. Juhend kompleksprofiili koostamiseks füüsilisgeograafilistel uurimistel [Instructions for the compilation of natural complex profiles in physico-geographical research]. Tartu State University rotary press (Tartu, 1962), 31 pp.

К о н г о, А г у. О почвенно-географических закономерностях в окрестностях Эльвы [Geographical peculiarities of soil distribution in the environs of Elva]. *Сборник научных трудов Эстонской сельскохозяйственной академии, Труды по почвоведению и агрохимии* [Transactions of the Estonian Academy of Agriculture, Investigations in soil science and agrochemistry], Vol. 24 (Tartu, 1962), pp. 163—172. With summary in German.

K o n g o, A g u. Elva ümbruse mullastiku rajoneerimisest [Soil regions in the environs of Elva]. *Loodusuurijate Seltsi Aastaraamat 1962* (Tartu, 1963), pp. 30—39. With summaries in Russian and German.

K o n g o, A g u. Soostunud leedemuldadest [Sloughy podsoles]. *Eesti Loodus*, Vol. VI, No. 4 (Tartu, 1963), pp. 226—228. With summaries in Russian and English.

K u l l u s, L e o. Märkmeid jäänähtuste pildistamisest [Notes on the photography of ice phenomena]. *Eesti Loodus*, Vol. IV, No. 2 (Tartu, 1961), pp. 101—103.

K u l l u s, L e o. Talvised ekspeditsioonid Peipsi-Pihkva järvel [Winter expeditions on Lake Peipsi—Pskov]. *Eesti Loodus*, Vol. VI, No. 6 (Tartu, 1963), pp. 357—360. With summaries in Russian and English.

Л е п а с е п п, В я й н о. О характеристике и учете географических условий при комплексном исследовании земельного фонда [Characteristics of geomorphological conditions in the complex study of land resources]. *Сборник научных трудов Эстонской Сельскохозяйственной Академии, Труды по почвоведению и агрохимии* [Transactions of the Estonian Academy of Agriculture, Investigations in soil science and agrochemistry], Vol. 24 (Tartu, 1962), pp. 36—42. With summary in German.

Л е п а с е п п, В я й н о (совместно с К. Т. Кильдема и А. А. Райк). Опыт ландшафтного исследования земельного фонда Эстонской ССР [Initial conclusions from studies of the land resources of the Estonian S.S.R.]. Вопросы ландшафтоведения. Материалы к VI-му Всесоюзному совещанию по вопросам ландшафтоведения (Problems of landscape science. Materials of the Sixth Assembly of Soviet Landscape Scientists) (Alma-Ata, 1963), pp. 336—343.

L e p a s e p p, V ä i n o. Maastikulise printsiibi rakendamisest maafondi uurimisel [Application of the landscape principle in investigations of land resources]. *Eesti Geograafia Seltsi Aastaraamat 1962* (Tallinn, 1963), pp. 59—76. With summaries in Russian and German.

L i n k r u s, E l l e. Rannajärvedest ja maagaasist Viinistu ümbruses [Coastal lakes and natural gas in the vicinity of Viinistu]. *Eesti Loodus*, Vol. III, No. 6 (Tartu, 1960), pp. 365—366. With summaries in Russian and English.

L i n k r u s, E l l e. Tartu Riikliku Ülikooli Üliõpilaste Teadusliku Ühingu Geograafia Ring aastail 1947—1962 [The Geography Study Circle of the Student Scientific Association of Tartu State University in 1947—1962]. Article in *Geograafiliste tööde kogumik I* [Papers on Geography I], Tartu State University rotary press (Tartu, 1962), pp. 3—19. With summary in Russian.

L i n k r u s, E l l e. Valgejõe alamjooksu oru geomorfoloogiast [On the geomorphology of the lower part of the Valgejõgi valley]. *Eesti Geograafia Seltsi Aastaraamat 1962* (Tallinn, 1963), pp. 28—45. With summaries in Russian and English.

L i n k r u s, E l l e. Andmeid maastikulisest keelualast «Valgejõe org» [Data

on the landscape reserve "Valley of the River Valgejõgi". Article in *Looduskaitsealaseid töid* [Papers on Nature Conservation], Tartu State University rotary press (Tartu, 1963), pp. 55—63. With summary in Russian.

Marksoo, Ago. Paul Theodor Krusenstern. *Eesti Loodus*, Vol. IV, No. 1 (Tartu, 1961), p. 37. In Estonian, with summary in Russian.

Marksoo, Ago. Fridtjof Nansen (1861—1930). *Eesti Loodus*, Vol. IV, No. 6 (Tartu, 1961), pp. 324—329.

Marksoo, Ago. [Amerigo Vespucci] (no heading). In the section "Meie kalender" [Our calendar] of *Eesti Loodus*, Vol. V, No. 1 (Tartu, 1962), p. 98.

Marksoo, Ann. Eesti põlevkivi tarbimise geograafiast [The geography of the consumption of Estonian oil-shale]. *Eesti Geograafia Seltsi Publikatsioonid III* (Tallinn, 1961), 59 pp. With summaries in Russian and German.

Марксоо, Анн. Проблемы формирования и развития северо-восточного экономического района Эстонской ССР [Problems of the formation and development of the economic region of NE Estonia]. *Geograafia-alaseid töid II. Tartu Riikliku Ülikooli Toimetised*, fasc. 128 (Tartu, 1962), pp. 35—141. With summaries in Estonian and German.

Marksoo, Ann. Ameerika Ühendriikide majandusrajoonid [Economic regions of the United States of America]. Tartu State University rotary press (Tartu, 1961), 70 pp.

Mihkelsoo, Aino. Uusi andmeid meresügavuste uurimisest [Investigations of marine depths yield new data]. *Eesti Loodus*, Vol. IV, No. 1 (Tartu, 1961), pp. 53—54.

Mihkelsoo, Aino. Uus huvitav sari [An interesting new series (of books)]. Critical review. *Eesti Loodus*, Vol. V, No. 1 (Tartu, 1962), pp. 59—60.

Murel, Virma. Vene asustusest Peipsi läänerannikul XVII sajandil [Russian settlements on the western shore of Lake Peipsi in the 17th century]. *Geograafia-alaseid töid II. Tartu Riikliku Ülikooli Toimetised*, fasc. 128 (Tartu, 1962), pp. 142—150. With summaries in Russian and German.

Nõmmik, Salme. Eesti NSV territooriumi geograafiline asend ja administratiiv-territoriaalne jaotus [The geographical position and administrative division of the territory of the Estonian S. S. R.]. Tartu State University rotary press (Tartu, 1961), 38 pp.

Nõmmik, Salme. Eesti NSV majanduslikust rajoneerimisest [On the division of the Estonian S. S. R. into economic regions]. *Geograafia-alaseid töid II. Tartu Riikliku Ülikooli Toimetised*, fasc. 128 (Tartu, 1962), pp. 3—34. With summaries in Russian and English.

Nõmmik, Salme. N. N. Baranski osa Nõukogude geograafia arengus [N. Baranski's role in the development of Soviet geography]. *Eesti Geograafia Seltsi Aastaraamat 1960/61* (Tallinn, 1962), pp. 322—336. With summaries in Russian and English.

Ныммик, Сальме. К вопросу изучения хингерланда города [On the study of the hinterland of towns]. *Публикации Эстонского географического общества V* (Tallinn, 1962), pp. 55—72. With summaries in Estonian and English.

Nõmmik, Salme. Majanduslike sidemete uurimisest [On the study of economic connections]. *Eesti Geograafia Seltsi Aastaraamat 1962* (Tallinn, 1963), pp. 155—166. With summaries in Russian and English.

Nõmmik, Salme. M. V. Lomonosov ja majandusgeograafia [M. V. Lomonosov and economic geography]. *Eesti Geograafia Seltsi Aastaraamat 1962* (Tallinn, 1963), pp. 199—209. With summaries in Russian and English.

Raik, Ants. Väike raamat suurest tööst [A little book about a great deal of work]. Critical review. *Eesti Loodus*, Vol. III, No. 6 (Tartu, 1960), pp. 379—380.

Raik, Ants. Üksikutest ilmavaatlustest esimeste vaatlusjaamade võrgu organiseerimiseni [From isolated weather observations to the establishment of the first network of observation centres]. *Eesti Loodus*, Vol. IV, No. 2 (Tartu, 1961), pp. 95—97. With summaries in Russian and English.

Raik, Ants. Kliima kui ilmade režiim [Climate as a regime of weather]. *Eesti Loodus*, Vol. IV, No. 6 (Tartu, 1961), pp. 330—333. With summaries in Russian and English.

Raik, Ants. Eesti meteoroloogiajaamade võrgu kujunemise ajaloost [From the history of the evolution of the Estonian network of meteorological stations]. *Eesti Geograafia Seltsi Aastaraamat 1960/61* (Tallinn, 1962), pp. 67—84. With summaries in Russian and German.

Raik, Ants (with I. Palm). Efektiivsete temperatuuride arvutamise võimalusest meteoroloogiliste elementide keskmiste väärtuste alusel ja efektiivsete temperatuuride jaotumusest suveperioodil Eesti NSV-s [The possibility of determining effective temperatures from mean values of meteorological factors, and their distribution during the summer period in the Estonian S. S. R.]. *Eesti Geograafia Seltsi Aastaraamat 1960/61* (Tallinn, 1962), pp. 95—105. With summaries in Russian and German.

Raik, Ants. 1960/61. aasta talve ekstreemsusest [The extreme character of the winter of 1960—1961]. *Eesti Loodus*, Vol. V, No. 1 (Tartu, 1962), pp. 17—19. With summaries in Russian and English.

Raik, Ants. Kliimaatilised aastaajad Eestis [Climatic seasons in Estonia]. *Geograafia-alaseid töid III. Tartu Riikliku Ülikooli Toimetised*, fasc. 144 (Tartu, 1963), pp. 33—46. With summaries in Russian and English.

Raik, Ants. Eesti asendist erinevate kliimaatiliste rajoneerimiste järgi [The position of Estonia according to various divisions into climatic regions]. *Eesti Geograafia Seltsi Aastaraamat 1962* (Tallinn, 1963), pp. 46—58. With summaries in Russian and German.

Raik, Ants. Kuurortide looduslikud eeldused [The natural preconditions of health resorts]. Chapt. II of «*Eesti NSV kuurordid*» [Health resorts of the Estonian S. S. R.]. State Publishing House (Tallinn, 1963), pp. 15—32.

Raik, Ants (with E. Pärnamägi, V. Soon and M. Soosaar). 1962. aasta ebasoodsa suve ilmastikust [The unfavourable weather in Estonia in the summer of 1962]. *Eesti Loodus*, Vol. VI, No. 4 (Tartu, 1963), pp. 205—209. With summaries in Russian and English.

Райк, Антс. О режиме гейзеров Камчатки [On the regime of the Kamchatka Geysers]. Article in *Исследование природы Дальнего Востока* [Studies of nature in the Far East], Academy of Sciences of the Estonian S. S. R. (Tallinn, 1963), pp. 39—95. With summaries in Estonian and English.

Райк, Антс. О применении косвенной характеристики радиационного режима при типизации пород [On the application of indirect characteristics of the radiation regime to the classification of weather]. *Geograafia-alaseid töid II. Tartu Riikliku Ülikooli Toimetised*, fasc. 144 (Tartu, 1963), pp. 23—32. With summaries in Estonian and English.

Рее, Таймо. О генетической классификации городских поселений Эстонской ССР до периода социализма (очерки формирования сеги городов, функциональной дифференциации и роста их) [The genetic classification of the urban settlements of the Estonian S. S. R. during the pre-socialist period (studies in the formation of the network of towns, their functional differentiation and growth)]. Author's abstract of dissertation for Candidate's degree in geography. Tartu State University (Tartu, 1962), 20 pp.

Рее, Таймо. О понятии генетической классификации городов [On the conception of the genetic classification of towns]. *Публикации Эстонского географического общества V* (Tallinn, 1962), pp. 26—33. With summaries in Estonian and English.

Tiik, Leo. Marie Underi esisadest [The forbears of Marie Under]. *Keel ja Kirjandus* ["Language and Literature"], Vol. V, No. 8 (Tallinn, 1962), pp. 495—496.

Tiik, Leo. Uhest kohanimest loodusteaduslikus aspektis [A place-name from the viewpoint of natural science]. *Eesti Loodus*, Vol. VI, No. 4 (Tartu 1963), pp. 245—247.

Tiik, Leo. Kes ja mis on mündrik? [The meaning of the word *mündrik*

(name of a type of dinghy and its rower)]. *Keel ja Kirjandus* ["Language and Literature"], Vol. VI, No. 7 (Tallinn, 1963), pp. 405—408.

Tiik, L'eo. Kust tuli eesti keelde *rootskäär*? [The origin of the word *rootskäär* (kind of dried fish)]. *Keel ja Kirjandus* ["Language and Literature"], Vol. VII, No. 3 (Tallinn, 1964), pp. 146—148.

Tiits, Heli. Geograafia töövihiku kasutamisest [How to use your geography exercise-book]. *Nõukogude Kool* ["The Soviet School"], Vol. XX, No. 2 (Tallinn, 1962), pp. 144—147.

Tiits, Heli. Iga geograafiatund peab olema kindlatel parteilistel alustel [Every geography lesson should be carried out in a conscious party spirit]. *Nõukogude Kool* ["The Soviet School"], Vol. XXI, No. 5 (Tallinn, 1963), pp. 367—372.

Varep, Endel. Geograafia ajaloo atlas [Atlas of the History of Geography]. Critical review. *Eesti Loodus*, Vol. III, No. 4 (Tartu, 1960), pp. 253—254.

Varep, Endel. NSV Liidu Geograafia Seltsi III kongress [Third Congress of the Geographical Society of the U. S. S. R.]. *Eesti Loodus*, Vol. III, No. 4 (Tartu, 1960), pp. 255.

Varep, Endel. Raamat Eestist võrsunud maadeuurijast [A book on Ed. Toll — an explorer from Estonia]. Critical review. *Eesti Loodus*, Vol. III, No. 5 (Tartu, 1960), p. 313.

Varep, Endel. Tartu. State Publishing House (Tallinn, 1961), 51 pp. English only.

Varep, Endel. Antropogeeni geoloogia osast maastikuteaduslikel uurimistel [The role of the geology of the Anthropogene in landscape science]. *Eesti NSV Teaduste Akadeemia Geoloogia Instituudi Uurimused* [Investigations of the Institute of Geology, Academy of Sciences of the Estonian S. S. R.], Vol. VII (Tallinn, 1961), pp. 233—238. In Estonian, with summaries in Russian and German.

Varep, Endel (with A. Mitt). M. V. Lomonosov — vene loodusteaduse rajaja [M. V. Lomonosov, the founder of Russian natural science]. Tartu State University rotary press (Tartu, 1961), 27 pp.

Вареп, Эндель. Физико-географическое (ландшафтное) районирование Эстонской ССР [Geographical regions of the Estonian S.S.R.]. *Latvijas Valsts Universitāte Zinātniskie Raksti* [Transactions of the Latvian State University], Vol. XXXVII (Riga, 1961), pp. 349—361. With summary in English.

Вареп, Эндель. О некоторых вопросах охраны ландшафтов (на примере Эстонской ССР) [Problems of landscape conservation in the Estonian S.S.R.]. *Материалы к V Всесоюзному совещанию по вопросам ландшафтоведения, Тексты докладов* [Materials of the Fifth All-Union Conference on Landscape Science, Published reports] (Moscow, 1961), pp. 246—252.

Varep, Endel. The rivers and lakes in the Estonian landscape. Article in "Water Deposits and Wetlands Require Conservation". Academy of Sciences of the Estonian S. S. R., Commission for Nature Conservation [Tallinn, 1962], pp. 7—17. English only.

Varep, Endel. Professor A. Tammekannu teaduslikust pärandist [A. Tammekann and his contribution to Estonian geography]. *Eesti Geograafia Seltsi Aastaraamat 1960/61* (Tallinn, 1962); pp. 346—354. With summaries in Russian and English.

Varep, Endel. NSV Liidu Geograafia Seltsi III kongress [The Third Congress of the Geographical Society of the Soviet Union]. *Eesti Geograafia Seltsi Aastaraamat 1960/61* (Tallinn, 1962), pp. 365—372.

Varep, Endel. V üleliiduline maastikuteadlaste nõupidamine [The Fifth All-Union Conference of Landscape Research]. *Eesti Loodus*, Vol. V, No. 1 (Tartu, 1962), p. 63.

Varep, Endel. Klaasitööstusest Eestis [The glass industry in Estonia]. *Eesti Loodus*, Vol. V, No. 2 and 4 (Tartu, 1962), pp. 137—141 and 199—204. With summaries in Russian and English.

Varep, Endel. M. V. Lomonosov ja Eesti NSV territooriumi geograafia-

line uurimine [M. V. Lomonosov and the geographical study of the territory of the Estonian S. S. R.]. *Geograafia-alaseid töid II. Tartu Riikliku Ülikooli Toimetised*, fasc. 128 (Tartu, 1962), pp. 151—163. With summaries in Russian and German.

Varep, Endel. Topograafilisest moodsustamisest Eestis aastail 1802—1811 [The topographic survey of Estonia in 1802—1811]. *Geograafia-alaseid töid II. Tartu Riikliku Ülikooli Toimetised*, fasc. 128 (Tartu, 1962), pp. 164—175. With summaries in Russian and English.

Varep, Endel. Fridtjof Nansen. *Eesti Geograafia Seltsi Aastaraamat 1962* (Tallinn, 1963), pp. 210—223. In Estonian, with summaries in Russian and English.

Varep, Endel. Tartu Riikliku Ülikooli geograafiaosakonna üliõpilaste diplomitöödest [On the Diploma Papers of the Students of the Geographical Department of the Tartu State University]. *Eesti Geograafia Seltsi Aastaraamat 1962* (Tartu, 1963), pp. 226—231. With summaries in Russian and English.

Varep, Endel. Über einige Karten Rußlands in J. B. Homann's Atlas vom Jahre 1725 [Some Maps of Russia in J. B. Homann's Atlas of 1725]. *Petermanns Geographische Mitteilungen*, Vol. 107, fasc. 4 (Jena, 1963), pp. 308—311.

Varep, Endel. Maastiku muutumine inimtegevuse mõjul ja maastike kaitse [Changes in the landscape as a result of human activity and nature conservation]. Article in *Maastike kaitse ja planeerimise küsimusi Eesti NSV-s* [Problems of the conservation and planning of landscapes in the Estonian S. S. R.], Academy of Sciences of the Estonian S. S. R., Commission for Nature Conservation (Tallinn, 1964), pp. 7—37. With summaries in Russian and German.

Vassiliev, Lev. «Mudavulkaan» Pedeli jõe ääres [“Mud Volcano” in the Pedeli River valley]. *Eesti Loodus*, Vol. III, No. 1 (Tartu, 1960), p. 46. With summaries in Russian and English.

Vassiliev, Lev. Epidiaskoobi kasutamine kartograafilise projektina [Epidiascope used as a mapping projector]. *Eesti Loodus*, Vol. III, No. 1 (Tartu, 1960), pp. 54—56.

Vassiliev, Lev. Pindalade mõõtmisest palettide abil [Measurement of surface areas by means of transparent net-tables]. *Eesti Geograafia Seltsi Aastaraamat 1960/61* (Tallinn, 1962), pp. 292—299. With summaries in Russian and German.

Vassiliev, Lev. Süstaga veeradadel [Along waterways in a collapsible skiff]. *Eesti Loodus*, Vol. V, No. 3 (Tartu, 1962), pp. 181—186. With summaries in Russian and English.

Vassiliev, Lev. Makro- ja telefotod aparaadiga «Smena» [Taking close-ups and telephotos with a “Smena” camera]. *Eesti Loodus*, Vol. V, No. 4 (Tartu, 1962), pp. 237—241. With summaries in Russian and English.

Vassiliev, Lev. Suusakelk [A sled with skis for its runners]. *Eesti Loodus*, Vol. V, No. 6 (Tartu, 1962), p. 374.

Васильев, Лев. Объект съёмки близко и далеко [Range-finding in photography]. *Советское фото*, Vol. XXII, No. 8 (Moscow, 1962), pp. 38—39.

Васильев, Лев. Использование дальномера при батометрических измерениях [Determination of sounding points by optical measurement of distances]. *Geograafia-alaseid töid II. Tartu Riikliku Ülikooli Toimetised*, fasc. 144 (Tartu, 1963), pp. 87—90. With summaries in Estonian and English.

Vassiliev, Lev. Diafilmide valmistamine ja demonstreerimine [The production and demonstration of filmstrips]. *Eesti Loodus*, Vol. VI, No. 1 (Tartu, 1963), pp. 45—50.

Vassiliev, Lev. Väklambi kasutamisest lähivõtetel [Using a flashlight for close-ups]. *Eesti Loodus*, Vol. VI, No. 2 (Tartu, 1963), pp. 119—120. With summary in English.

Vassiliev, Lev. Omavalmistatud teleobjektiiv [A do-it-yourself tele-objective]. *Eesti Loodus*, Vol. VI, No. 3 (Tartu, 1963), pp. 185—186. With summaries in Russian and English.

Vassiliev, Lev. Album fotodest formaadiga 9×12 cm [An album of 9×12 cm photographs]. *Eesti Loodus*, Vol. VI, No. 6 (Tartu, 1963), p. 374.

Vassiliev, Lev. Mõõteratas teekonna pikkuse mõõtmiseks [Wheelbarrow for measuring distances covered]. *Eesti Loodus*, Vol. VI, No. 1 (Tartu, 1964), p. 48. With summaries in Russian and English.

Vassiliev, Lev. Väikekaamerast kopeerimisraam diapositiivide valmistamiseks [Small-size camera used as copying-aid for making slides]. *Tehnika ja Tootmine* [Technology and Industrial Output], Vol. VIII, No. 1 (Tallinn, 1964), p. 29.

Vassiliev, Lev. Kordus- ja viitsäritused fotoaparaatidega «Zenit», «Zorki» ja «FED» [Double and repeated exposures with "Zenith," "Zorky" and "FED" Cameras]. *Tehnika ja Tootmine* [Technology and Industrial Output], Vol. VIII, No. 1 (Tallinn, 1964), p. 29.

Васильев, Лев. Световая указка [A luminous pointer]. *География в школе*, Vol. 27, No. 1 (Moscow, 1964), p. 61.

Earlier works by the aforementioned authors are listed in "The Development of Geography in the Estonian S. S. R. 1940—1960." Publications of the Estonian Geographical Society, Vol. II (Tallinn, 1960).

CONTENTS

E. Varep. The landscape-regions of Estonia	3
E. Hang, T. Liblik and E. Linkrus. On the relations between Estonian valley terraces and lake and sea levels in the Late-Glacial and Holocene periods	29
V. Lepasepp. On the application of the landscape principle to the study of land resources	43
S. Nõmmik. On the economic regionalization of the Estonian S. S. R.	55
T. Rea. On the ways of development and genetic classification of Estonian urban settlements	87
E. Varep. Count L. A. Mellin and his "Atlas of Livonia"	106
A. Raik. Data on Kamchatka geysers	132
E. Varep. The Geography Department of Tartu State University	140

SISUKORD

E. Varep. Eesti NSV maastikuline liigestus	27
E. Hang, T. Liblik ja E. Linkrus. Märkmeid oruterasside seose kohta hilisjääaja ning holotseeni järve -ja meretasemetega Eestis	41
V. Lepasepp. Maastikulise printsiibi rakendamisest maafondi uurimisel	53
S. Nõmmik. Eesti NSV majanduslikust rajoneerimisest	84
T. Rea. Eesti linnaliste asulate arenguteedest ja geneetilisest klassifitseerimisest	105
E. Varep. L. A. Mellini «Liivimaa atlasest»	130
A. Raik. Andmeid Kamtšatka geisritest	139
E. Varep. Tartu Riikliku Ülikooli Geograafiaosakond	150

СОДЕРЖАНИЕ

Э. Вареп. Ландшафтное районирование Эстонской ССР	28
Т. Либлик, Э. Линкрус и Э. Ханг. К вопросу о корреляции долинных террас с уровнями позднеледниковых и голоценовых озерных и морских водоемов на территории Эстонии	42
В. Лепасепп. О применении ландшафтного принципа при исследовании земельного фонда	53
С. Ныммик. К вопросу об экономическом районировании Эстонской ССР.	85
Т. Реа. О путях развития и генетической классификации городских поселений Эстонии	105
Э. Вареп. Об «Атласе Лифляндии» Л. А. Меллина	131
А. Райк. Некоторые данные о гейзерах Камчатки	139
Э. Вареп. Географическое отделение Тартуского государственного университета	150

PUBLICATIONS ON GEOGRAPHY
TARTU RIIKLIKU ULIKOOLI TOIMETISED
УЧЕННЫЕ ЗАПИСКИ ТАРТУСКОГО ГОСУДАРСТВЕННОГО
УНИВЕРСИТЕТА

Previously published:

Varem ilmunud:

Вышли в свет:

1. GEOGRAAFIA-ALASEID TÖID I — ТРУДЫ ПО ГЕОГРАФИИ I, Тарту, 1960.

- S. Nõmmik. Majanduslik rajoneerimine teoorias ja rahvamajanduse praktikas. С. Ныммик. Экономическая районирование в теории и в народнохозяйственной практике. *Resüme.* S. Nõmmik. Die ökonomische Rayonierung in der Theorie und in der volkswirtschaftlichen Praxis. *Zusammenfassung.*
- T. Rea. Eesti NSV linnaliste asulate geneetilise klassifikatsioonist (sotsialismi-eelsel perioodil). Т. Реа. О генетической классификации городских поселений Эстонской ССР (досоветский период). *Resüme.* T. Rea. Zur genetischen Klassifikation der städtischen Siedlungen des bürgerlichen Estlands. *Zusammenfassung.*
- T. Rea. Eesti ala linnade funktsionaalsed tüübid XX saj. alguses. Т. Реа. Функциональные типы городов Эстонского края в начале XX в. *Resüme.* T. Rea. Die funktionellen Typen der Städte des estnischen Gebiets am Anfang des XX Jahrhunderts. *Zusammenfassung.*
- Э. Вареп. Исторический очерк картографии Эстонии (до 1917 года). E. Vaer. Eesti kartograafia ajaloost. *Resüme.* E. Vaer. From the History of Estonian Cartography. *Summary.*
- Л. Васильев. Первые инструментальные съемки на территории Эстонской ССР. L. Vassiljev. Esimesed instrumentaalsed mõdistustööd Eesti NSV territooriumil. *Resüme.* L. Wassiljew. Die ersten Messtischaufnahmen in Estland. *Zusammenfassung.*

2. GEOGRAAFIA-ALASEID TÖID II — ТРУДЫ ПО ГЕОГРАФИИ II, Тарту, 1962.

- N. Nõmmik. Eesti NSV majanduslikust rajoneerimisest. С. Ныммик. Об экономическом районировании Эстонской ССР. *Resüme.* S. Nõmmik. On the Division of the Estonian S.S.R. into Economic Regions. *Summary.*
- A. Marksoo. Проблемы формирования и развития Северо-Восточного экономического района Эстонской ССР. A. Marksoo. Kirde-Eesti majandusrajooni kujunemise ja arengu probleeme. *Resüme.* A. Marksoo. Probleme der Formierung und Entwicklung des nordostestnischen Wirtschaftsgebietes. *Zusammenfassung.*

Тартуский государственный университет
ЭССР, г. Тарту, ул. Юликооли, 18

ТРУДЫ ПО ГЕОГРАФИИ
IV

На английском, русском и эстонском
языках

Toimetaja E. Vager

Korrektorid A. Hone, O. Mutt, S. Oleneva
ja E. Vohandu

Ladumisele antud 15. VI 1964. Trükkimisele antud
9. VII 1964. Paber 60 × 90, 1/16. Trükipoognaid
9,75 + 13 lisa. Arvestuspoognaid 12,7. Trükiarv 500.
MB-04437. Tellimuse nr. 5041. Hans Heidemanni
nim. trükkikoda. Tartu, Ülikooli 17/19. II.

Hind 1.20 rbl.

- V. Murel. Vene asustusest Peipsi läänerannikul XVII sajandil. В. Мурель. О расселении русских в западном Причудье в XVII веке. Резюме. V. Murel. Zur Besiedlung des westlichen Peipusufers im 17. Jahrhundert durch die Russen. Zusammenfassung.
- E. Vager. M. V. Lomonossov ja Eesti NSV territooriumi geograafilise uurimise. Э. Вареп. М. В. Ломоносов и географическое исследование территории Эстонской ССР. Резюме. E. Vager. M. W. Lomonossov und die geographische Erforschung Estlands. Zusammenfassung.
- E. Vager. Topograafilisest mõõdistamisest Eestis aastail 1802—1811. Э. Вареп. О топографической съемке в Эстонии 1802—1811 гг. Резюме. E. Vager. The topographic survey of Estonia in 1802—1811. Summary.

3. GEOGRAAFIA-ALASEID TÖID III — ТРУДЫ ПО ГЕОГРАФИИ III, Тарту, 1963.

- H. Liidema. Tuule profiilist maalähedases õhukihis Tartu ümbruse andmel. X. Лийдема. О профиле ветра в приземном слое воздуха по данным окрестности Тарту. Резюме. H. Liidema: The Wind Profile in the Lowest Layers of the Atmosphere on the Basis of Data from the Surroundings of Tartu. Summary.
- A. Raik. О применении косвенной характеристики радиационного режима при типизации погод. A. Raik. Kiirgusrežiimi kaudsete karakteristikute rakendamise ilmade tüpiseerimisel. Resümee. A. Raik. On the Application of Indirect Characteristics of the Radiation-Regime to the Classification of Weather. Summary.
- A. Raik. Kliimaatilised aastaajad Eestis. A. Raik. Климатические времена года в Эстонии. Резюме. A. Raik. Climatic Seasons in Estonia. Summary.
- H. Темникова. Опыт климатического районирования Прибалтики для курортов. N. Temnikova. Baltimaade kliimaatilise rajoneerimise katse kuurortide vajadusteks. Resümee. N. Temnikov. An Attempt at the Division of the Baltic Republics into Climatic Districts from the Point of View of Holiday Resorts. Summary.
- L. Глазачева. Термика озер Латвии в безледный период. L. Glazatšova. Temperatuuritingimused Läti järvedes jäävabal perioodil. Resümee. L. Glazacheva. Thermal Conditions of Latvian Lakes in Ice-Free Periods. Summary.
- L. Васильев. Использование дальномера при багометрических измерениях. L. Vassiljev. Kaugusemõõtja kasutamine veekogu sügavuste mõõtmisel. Resümee. L. Vassiliev. Determination of Sounding Points by Optical Measurement of Distances. Summary.