LITHUANIAN LOCAL RESEARCHES
"Lietuvos Valsčiai" Monograph Series
Collected Scientific Papers

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Lithuanian Local Researches:
"Lietuvos Valsčiai" Monograph Series
Collected Scientific Papers 2002–2005

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Gelvonai cemetery chapel. 2004. Photo by Aloyzas Petrašiūnas

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Contents of English Summary of the Volume

374 Preface

375 *Algirdas Gaigalas.* Local researches of Lithuanian nature (introduction)

379 Summaries of scientific papers

393 About authors

Preface

From 1994 Versmė Publishing House is dealing only with preparation and publishing of the Lietuvos Valsčiai (Lithuanian Rural Districts) – a series of local monographs devoted for the Millennium of Lithuania (1009–2009). Fourteen series of the monographs have already been issued with a total number of book pages being 14,648. Now 30 more book series are being prepared for press (see www.versme.lt). After all, Lithuania had had more than 400 districts, thus, the total series set should embrace a similar number of volumes…

Before 2005 inclusive, the Versmė organised 55 special research expeditions to the local areas under description with 1,008 authors of the monographs having taken part to collect data for their studies and papers. Environmentalists were especially active authors and participants of these research expeditions. We are sincerely thankful to Academician Prof. Dr. habil. Algirdas Gaigalas, Prof. Dr. Ričardas Kazlauskas, Prof. Dr. habil. Valentinas Baltrūnas, Docent Dr. Živilė Lazdauskaitė, Docent Dr. Filomena Kavoliūtė, Dr. Rimvydas Kunskas and other scholars. Over 90 degree holders write for the Lietuvos Valsčiai series.

The first monographs of Lietuvos Valsčiai were based on descriptive articles. Later, as the scholars joined this work and scientific papers were accumulating, it was decided to form an independent authoritative Commission for Scientific Papers with its members being highly qualified experts in the fields covered in the series to evaluate the quality of the papers presented. I am honestly grateful to the Commission members Academician Prof. Dr. habil. Algirdas Gaigalas (nature), Dr. Artūras Judžentis (language), Prof. Dr. habil. Irena Regina Merkienė (ethnology, Commission head), Prof. Dr. habil. Stasys Skrodenis (folklore), Academician Prof. Dr. habil. Antanas Tyla (history) and Dr. Gintautas Zabiela (archaeology) for strictness in reviewing and the important work done. Only papers approved by the Commission are noted as the scientific works in the series.

For the first time, the Commission-approved scientific papers were published in Seredžius monograph in 2003 (of 15 papers two ones dealt with nature, five with history, six with ethnical culture, one with folklore and one was of a biographical character). Later such papers appeared in the following monographs: Kvėdarna (2004, 6 papers), Papilė (Part I, 2004, 11 papers including 2 on the environment), Tauragnai (2005, 4 and 2), Musninkai. Kernavė. Čiobiškis (2005, 7), and Laukuva (Part I: 2005, 10 and 1).

The issue date for books prepared depends greatly on funding. Since the sale of Lietuvos Valsčiai series volumes on history and ethnical culture do not cover all expenses of preparation and publication, the permanent support is necessary. Unfortunately, state institutions do not provide systematic support of this activity, and local governments further the publishing of the series only partly. Therefore, Versmė tries to find sponsors and funding sources, but the accumulation of funds necessary for publishing activities takes much time and is rather indefinite. Due to permanent lack of funds, the printing of the books is slow. To speed up the issue of scientific papers presented for the series Versmė allocated a part of its own resources to publish the Lithuanian Local Researches – collected scientific papers – presented to the Lietuvos Valsčiai series on nature, archaeology, history, ethnical culture, language, folklore, and sociology in separate subject volumes. We shall try to reach such an order that the time from preparation/presentation of the articles to the Commission and their publication did not exceed one year. The collection is starting with the volume consisting of scientific papers (written in 2002–2005) dealing with nature, since this part of local research is the first to be compiled under the guidance of Academician Algirdas Gaigalas, Chief Editor of this volume, and the efforts of tireless Editor Vida Girininkienė.

Local scientific investigations from various Lithuanian areas presented in one collection will help people not only to recognise Lithuania, which is to celebrate the millennium of its name and is still unfamiliar, in a general European context, but also will be used in future works. We hope that the collected scientific papers issued under the private initiative and funding will attract the attention, evaluation and support of state and science institutions; moreover, the timely issue of the collection volumes will be a stimulus for researchers to be more active in local investigations and to become authors of the Lietuvos Valsčiai series. We are kindly waiting for response of readers and their proposals and hope that the Lithuanian Local Researches will find its place in general space of local scientific investigations.

Petras Jonušas, Publisher of the Lietuvos Valsčiai series
Vilnius, July 11, 2006

Local researches of Lithuanian nature

By Algirdas Gaigalas

The Versmė Publishers issue "Lietuvos Valsčiai" – the series of books about rural districts in pre-war Lithuania. The scientific research material scattered in those books acquires qualitatively new value in separate volumes of Collected Scientific Papers which, otherwise could remain unnoticed in the *Valsčiai* publications.

This collection of local environmental research publications is the first attempt in the Lithuanian scientific publishing practice. We miss such a journal that would deal with both the geosciences (geology and geography) and the biosciences. We have no doubt that it will receive some proper recognition not only from the experienced but also beginning authors working in various fields of organic and inorganic nature research.

The research of the rock and deposit exposures on river slopes, quarries and pits, the finding sites, the habitats, the hatching and spawning places, some local phenomena, their repetition, etc., has been carried out. Environmental researches are first begun in some local site. Later they are expanded and acquire some regional character. The results of regional research are compared and generalized in a global sense. Thus, the consecutive environment research system exists, the first and the most important link of which is the observation of local phenomena. It is the beginning of all the motivated serious environment research aims. Without local research data, many theoretical considerations would remain only a hypothesis.

During the centuries, local natural conditions formed ethnic culture of local people, their way of thinking and life, temper and character peculiarities, anthropological features, etc. The local variety of natural conditions was responsible for isolation of tribes. It was significant for their historical development and protected them from disastrous phenomena. The Nature fed, granted refuge and defended them from enemies. We live and act in a specific local, complex, radiometric, graviometric, magnetic biofield of the Earth.

Lithuania, as one of the Baltic countries, is situated in the Baltic geographical region. Looking at this region from the East, it is called the Baltic land because it is at the Baltic Sea. From the point of view of the Westerners it is the Eastern Baltic Sea coast, that is why they call this region the East Baltic or simply the Baltic countries. The Baltic countries belong to the East European platform geological structure super region, morphologically – to the East European plain, sometimes called the Russian plain or more exactly – to its Western part. The East European platform super region is a part of the European continent. The continents of Europe and Asia are joined into a major Earth crust global Euro–Asian continent plate. These geological structures are predetermined by the Earth development local, regional and global factors having interconditional bond and harmony. It is possible to group those conditional factors according to their local, regional and global hierarchy. Such experiments have been done by the naturalists. We shall try to do it as well.

Local natural phenomena and elements are conditioned by cosmic, global and regional factors. Natural environment is influenced by different factors. They formed

it in the continuation of geological time and expressed themselves in the space of the planet Earth. These factors influence natural environment now as well, and later they will manifest in that space and time continuation.

We begin this hierarchy of natural environment influencing factors from the astronomical and cosmic phenomena that came into existence because the Sun Earth's orbit around the Sun is changing and other reasons. They are called Milankovitch's cycles:

- orbit eccentricity changes,
- inclination (leaning) changes,
- equinox divergences,
- insolation variations, etc.

Here not only meteorites and cosmogenic catastrophes may be ascribed but also radiation and material from the outer space.

The global factors influencing regional and local natural environment are obvious. They include:

- phenomena in the Earth crust and under it (the mantle viscosity, the deformations due to the Earth crust plate interactions and ice cover weight influence),
- water level fluctuations in the oceans because of climate changes (glaciations and deglaciations),
- the Earth magnetic pole migration,
- tectogenesis and orogenesis, etc.

Regional factors are also important for natural environment:

- ice cover formation, dynamics and spreading,
- glacioisostatic movements,
- aeolian activity,
- volcanic activity,
- permafrost formation,
- hydro-meteorological phenomena and circulation of atmospheric masses,
- links in the atmosphere–hydrosphere–lithosphere system, etc.

Local factors also include relief peculiarities, geological structure and composition components, meteorological and climatological factors, etc.

The enumerated factors determine local phenological phenomena and spatial environmetal variations:

- plant taxonomy, tree demography and migration,
- bird migration,
- insect spreading,
- mammal existence,
- vertebrate way of life,
- invertebrate reaction, etc.

First of all natural environment variations depend on climatic changes. Climate is a multicomponent system changing in space and time. The whole hierarchy of the already mentioned and other factors, as a matter of fact, control local climatic

changes in a certain restricted territory. They begin from the outer climatic system influencing factors and end by the local factors taking place in a restricted area.

In 1997 Patrick J. Bartlein founded the systematic natural environment and climate influenced factors during the latter geological period – the Quaternary that began according to some estimations 1,650,000 years ago.

The climatic system influencing factors and the hierarchy of their influence features (P. J. Bartlein, 1997)

Outerly influencing	astronomical solar (radiation, orbital changes) tectonic (continent spreading, mountain barriers) ocean currents and barriers atmosphere composition
Influences (changes) on a global scale	latitudinal and seasonal spreading of insolation ice volume atmosphere composition energy balance zones
Influences (changes) on hemispheric scale	general atmosphere circulation (e. g. westward) general ocean circulation thermohaline ocean circulation
Influences (changes) on the continental scale	atmosphere circulation peculiarities (e. g. the Aleutian Islands low pressure, the East Pacific ocean subtropical high pressure) the Earth surface cover the sea surface temperature character
Influences (changes) on a regional scale	the dislocation of predominating storm routes the distribution of air masses (warm and humid currents)
Influences (changes) on a mesoscale	precipitation wind fields split by orography
Influences (changes) on a local scale	precipitation, temperature episodic short wave radiation general radiation water steam pressure wind velocity soil humidity atmospheric precipitation illumination

This hierarchy explains natural environment and climatic peculiarities. The changes (their signs, indicators) predestined by higher level global, continental and regional factors reflect themselves in local natural environment. Local factors cannot influence (predetermine) global system general state. E. g., atmosphere circulation major changes can give rise to warmer or colder climate in several regions, however, they don't change climatic conditions in other regions. It is not always possible to reveal the global, hemispherical, continental, regional reasons of changes in local natural conditions. Local investigations are important while carrying out the monitoring and phenological observations of natural phenomena. The long-term data allow to establish the recurrent cycles of natural phenomena that help not only to reconstruct past phenomena but to predict and control them in the future. Local

nature investigations and their results are important while managing the territories under protection and, on the whole, for land management, nature usage and nature conservation.

The planet of Earth is an independent nature system in the cosmic structure. The relation of different spheres – lithosphere, hydrosphere, atmosphere, biosphere, technosphere, anthroposphere and nanosphere (reason sphere) – exists in it. The task of the environmental research is to take that relation into consideration from the point of local, regional and global view. The evaluation of these relations is an important future science task while improving environment, avoiding unfavorable phenomena, etc.

Thus, the importance of local environment research tasks becomes obviously evident.

There is no need, to my mind, to present this collection specially. Its subjects and structure are reflected in the contents of the publication. We see here the kaleidoscope of natural environment, its expression and changes. Scientific review, methodical and research works are published in the collection "Lithuanian Local Researches. Nature". Many scientific papers are prepared by the researchers of Lithuanian scientific institutions. New investigations by the Lithuanian Nature Society members are published in this issue. The subjects of the papers are divided and presented in accordance with the main natural science trends in an alphabetic order: biology, geography and geology.

This facilitates orientation of those who are interested in scientific local problems while presenting the publication for the first time. Problems of local natural sciences are various and universal. They reveal themselves well only in such publication of wide nature subjects. We hope that this first volume of the "Lietuvos Valsčiai" monograph series on Lithuanian local researches, a collection of scientific works, will be only the beginning of the task set to issue the collection periodically. The Lithuanian Nature Society should occupy its proper place in the local researches in the future.

Summaries of scientific papers

Tauragnai land flora peculiarities

/TAURAGNAI

By Živilė Lazdauskaitė

Vilnius Pedagogical University

The Land of Tauragnai is considered to be the area surrounding the main regional object – Lake Tauragnas. The territory under discussion is distinguished for its environmental diversity which predetermined a great variety of plant species and communities (about 600) growing here. A great part of the territory is covered by forest. Pine woods occupy the largest areas of these forests. Pure spruce-groves almost don't exist here. Birch groves are scarce and occupy little areas in former pinewood habitats. Alder groves grow in narrow belts on the lake shores, mainly on the rivulet banks. There are many swamps of various sizes among hills, low-lying marshy land type plant communities have established themselves there. Large former cultivated field areas lie fallow, untilled in the territory at present, the plants characteristic of forest outskirts and grounds gradually settle in them. Many rare species introduced into the Lithuanian Red Book grow in the land of Tauragnai. *Epipogium aphyllum* was found in the forest of Ažvinčiai, *Betula nana* grows in the upland moor of Minčia forest and *Dracocephalum ruyschiana* grows in the dry pinewoods. *Listera cordata*, *Malaxis monophyllos*, *Liparis loeselii*, *Corallorhiza trifida* grow on the damp lake shores and in the marshes. *Ajuga pyramidalis*, *Dracocephalum ruyschiana*, *Arenaria saxatilis*, *Pulsatilla patens* occur in the open woodlands of the forests Daunoriai and Minčia. *Gentiana cruciata* grows in the meadow communities at Daunoriai. *Cladium nariscus*, *Scolochloa festuracea*, *Alisma gramineum* grow on the Tauragnas shores. *Najas marina* and *Hydrilla verticillata* were found at the lakes of Baltelis and Byvainėlis. Herb gathering and usage traditions are known in the land of Tauragnai from olden times. They number about 200 species.

Farm-stead green plantations, orchards, nature gifts in the north of Rokiškis land

/JUODUPĖ. ONUŠKIS

By Jonas Šedys

About 1940 some old villages' green plantations and their vivid fragments in many other areas still survived. Abundant lime, maple, ash-tree, *Salix alba var argentea* and rare oaks grew in old villages. Birches grew along the road Juodupė–Onuškis. Decorative bushes and shrubs included lilacs, jessamines, snowball trees, bird-cherries, spiraeas, snowberries, slovenwoods.

While individual farms were being established, the following species of trees and bushes were used: pine, spruce, rowan-tree, horse-chestnut, poplar, pea

shrub, hagrose, Russian olive (*Elaeagnus angustifolia*) and purple osier willow (*Salix purpurea*).

Perennial flowers predominated in flower gardens of old villages. They were: green rue, *Rudbeckia laciniata*, phlox, tiger lily (*Lilium lancifolium*), common peony, evening primrose, garden asparagus, bleeding heart, day lily and reed canary grass. Also annual flower species were spreading in the individual farms: dahlias, daffodils, irises, later also tulips and gladioli.

Some beautifully blossoming local flora plants were not cultivated in the flower gardens but blossoms of many of them were picked up for bunches, garlands and wreaths. Especially great respect was assigned to such plants as: pasqueflower, windflower, globeflower, primrose and lady-slipper.

There were no orchards, only solitary apple-, cherry-, plum-trees and currant-shrubs grew at those old village farm-steads. Only a rare farm-stead owner planted an orchard, many of them restricted themselves by planting a few fruit-trees. Old folk selection, well-known apple-trees were spreading. Only thanks to horticulture enthusiasts, fertile and good taste apple-tree species now widely known reached these places. Quite a few of them now would be worth cultivated in ecological orchards. Sour cherries (*Cerasus austere*) predominated, they grew high and gave poor harvest. Only some farm-steads at Onuškis cultivated *Cerasus collina* producing abundant harvest of vividly red, big berries. They spread into many other localities. Few plum-trees were cultivated, people did not know how to look after them, thus, their harvest was poor. Red currants producing abundant harvest every year were cultivated almost everywhere, and black currant species began spreading.

From olden times various wild berries: such as cloudberry, raspberry, cranberry, bilberry, cow-berry, wild strawberry were being gathered. Only bog whortleberries and roebuckberries were not gathered. Many people were fond of mush-rooming. Everybody gathered edible boletus, orange-cap and birch boletus, yellow boletus, chanterelles and various russules and only experienced muchroomers gathered white-caps. Some older people gathered medicinal herbs, they asked their grandchildren to help. Some forage plants also were gathered.

The butterflies of Seredžius environs

/SEREDŽIUS

By Ričardas Kazlauskas

Vilnius University

There are peculiar ecological conditions in the surroundings of Seredžius. The slopes of the Nemunas River valley grow warm very much in summer, therefore many species of southern plants grow here, hornbeam groves thrive rankly. That influenced the fauna of butterflies. Besides the species widely spread in Lithuania, a number of southern butterfly species, which are spread in South Lithuania and farther in Central Europe were found here. Such as: *Roselia strigula*, *Heterogena asella*, *Drepana harpagula*, *Catocala promissa*, *Anticlea badiata*, *Pseudoips prasinana*, *Strymon spini* and

many others should be mentioned. Some species of this southern group were found in Lithuania for the first time; i. e.: *Psoricoptera speciosella*, *Cochylis hybridella*, *Phiaris septentrionana*, *Lobesia abscisana*, *Phycitodes maritima*, *Scoparia subfusca*. Taking into consideration the rare butterfly species concentration, a butterfly preserve is recommended to be established in the valley of the Dubausis rivulet.

From a big flock of birds /*GELGAUDIŠKIS*

By Vitas Stanevičius
Vilnius University Ecology Institute

The composition of Gelgaudiškis region bird fauna is determined mostly by the lack of natural water reservoirs, old intensive agricultural traditions, a close neighbourhood of the Nemunas River and a large forest of Kazlų Rūda. About 130 bird species hatch there, 19 of them are included into the Red Book of Lithuania. One species, the corn crake (landrail), belongs to a globally becoming extinct category. The biggest centres of bird abundancy and variety (especially of rare water- and swamp-loving species) in the country are as follows: the ornithological preserve of Novaraistis, the clay quarries of Gelgaudiškis and the Nemunas riversides, including old river-beds. The Novaraistis ornithological preserve distinguishes itself by the most abundant accumulations of grey crane: about 300 specimens spending summers and up to 2,000 migrating ones. This place is in conformity with the international bird protection organization BirdLife International requirements applied to single out the territories important for birds in Europe, it is also in conformity with the criteria for protectable territories of international importance established by the Convention of Ramsar.

Air basin pollution aspects /*GELGAUDIŠKIS*

By Donatas Perkauskas
Environment Protection Agency

The local transport-caused air pollution in Gelgaudiškis, situated at the Lower Nemunas, is greatly influenced by meteorological conditions. The pollution increases when temperature inversions and mist form. The CO concentration is less than allowable, i. e. 5 mg/m^3. From the air pollution point of view Gelgaudiškis may be assigned to the cleaner little towns at the Nemunas River. The town and its environs are suitable for developing recreation and tourism.

Nature and recreation sites in Plungė environs /*PLUNGĖ*

By Merūnas Lankelis and Ramunė Urbonienė
Klaipėda University

Plungė District distinguishes from other districts of Lithuania for its natural resources potential of tourism and recreation development. The tourism is one of the most perspective business activities in the district. The tourism products of Plungė District – historical, cultural heritage, nature, environment and its offered entertainment and amenity. The main components of tourism industry, which attract tourists to come here, are sport and leisure entertainments, camps, staying overnight in nature and natural rural environment, national cuisine, fresh and ecological products, pleasant means of communication (on foot, by bicycle, boat, scull, horse, etc.). Architectural, historical, natural and art monuments, which are plentiful in Plungė District, also are attractive for tourists. A fair part of Plungė District is included in state protective areas (Žemaitija National Park) with cognitive tourism being a priority.

Tourism resources of Plungė District consist of:

- Natural resources;
- Cultural resources;
- Tourism infrastructure.

Large meaning for recreation has lakes and rivers. They are very attractive objects for holidaymakers. There are aplenty of various species of fish, which attract amateur professional fishermen. There is the possibility to equip a centre of water amusement and sports in Plungė.

Water tourism of Plungė District contains:

- the Plungė Sea;
- the Babrungas River (especially in Vandentiekio street);
- the Medingėnai Dam (gravel pit);
- the Lake Norvilai.

In the forests of the region under consideration trees of various species are growing, but coniferous woods (pine, spruce) predominate. Deciduous trees – oak, birch, quaking aspen and nut trees are rather common as well. There are plenty of recreational forests in the mentioned territory. The most important function of them is to meet recreational needs and to make conditions for rest.

The most popular of all forms of recreation in the nature is relaxation in the forests, where family holidaymaking for groups of 3–5 persons dominate. One visit to a forest on the average lasts for about 4.2 hours. However, holidaymakers like not all the forests, especially those lacking good conditions for maximum meeting recreational needs and minimum affecting natural processes in the ecosystems.

The recreational activity includes also trips, traveling by boat, bicycling, traveling by automobile, mushrooming and berrying. The conception of recreational usage takes priority in the formation of the system of such tourism forms as motor, bicycle, pedestrian and water tourism. There are both the most desirable components

for the holidaymakers in the analyzed territory – forest and water. So, a large flow of holidaymakers in summer is quite understandable.

The perspective direction of recreational usage is to enlarge cognitive attendance of the territory, and to seek that season of attendance be as long as possible and continued not only during the summer. Therefore, the biggest attention in planning the recreational infrastructure must be paid to the protection of the natural cultural resources and to the development of the territorial system of the tourism.

Cultural landscape development in Laukuva environs */LAUKUVA I*

By Filomena Kavoliutė
Vilnius University

The environs of Laukuva have been inhabited since the beginning of our era. Such attachment to a constant settlement, probably, has been predetermined by the infertile hard culturized acid soils.

Up to the very beginning of the 20th c. gentry villages had survived in the environs of Laukuva. Most of them had been established in the highest places of Laukuva ridge where lighter soils are spread. Besides, these were large 60–70 ha farms, so called *užusieniai* (beyond borders). The status of an individual farm-stead showed not only different property situation of its owners, but also personal liberties in the former serfdom society.

The environs of Laukuva–Padievytis as an old cultural landscape region distinguished themselves in the first half of the 20th c. by small wood areas and small arable land plots that made up hardly 25–50% of rural land area and intensively exploited small peat-bogs. Meadows and pastures predominated here.

During the land-reclamation carried out in the Soviet period in the second half of the 20th c. the environs of Laukuva lost a significant part of its historically conditioned agricultural landscape and also a part of its historical memory associated with it.

20th c. Kartena landscapes */KARTENA*

By Filomena Kavoliutė
Vilnius University

The asymmetry of old Kartena *Valsčius* and its coincidence with the Minija River basin show that the natural environmental conditions had great importance for the formation of this subdistrict.

There are almost no forests because of long-duration and intensive farming in the vicinities of the oldest settled Minija–Salantas valleys. Their largest areas have survived on the watersheds of Minija–Akmena and Minija–Alantas.

In the first half of the 20th c. Kartena *Valsčius* was settled unequally: the greatest density was at the approaches to Kartena, about 10–13 farm-steads in 1 km^2, and the least density was in the south–eastern part with about 5–8 farmsteads in 1 km^2.

The rise of new for rest assigned farm-steads and the application of those survived for rest show that the environs of Kartena is in the zone of direct influence by Klaipėda.

20th c. changes in land-management and land-ownership in Tauragnai environs

/TAURAGNAI

By Jonas Milius and Jolita Lukštaitė

Vilnius University

The Lithuanian landscape changed very much in the 20th c. Many aspects conditioned this change. The most important of them that formed this trend are vivid political-economical alterations of this period, not always they were carried out of our own free will. Besides, the territory of Lithuania, though comparatively not large, is not compact from the nature point of view. Varied landscape development was revealed in the background of the above-mentioned changes. Thus, the variety of landscape territorial natural complexes played a limiting role and caused the change scale in this process.

The environs of Tauragnai are not very exceptional territories from the viewpoint of nature but the conditions for agricultural activities here are unfavourable. However, the research data of some authors witness that agricultural landscape in this region began forming about two thousand years ago. Until World War I the peasants in the territory under analysis lived mostly in the street-type villages and the farming was carried out in accordance with the triple field (land plot) agriculture model. This system was eliminated while carrying out Stolypin's land reform in 1907–1914 but mostly while carrying out the Interwar Lithuanian land reform in 1918–1940. Thus, individual farm settlement system and lot land cultivation were formed. Middle-size (8–30 ha) farms predominated in the territory of *Valsčius* (a rural administrative unit, a kind of a borough with its vicinity). The area of arable land made up only 48.1% of the whole agricultural territory because of the complicated dismemberment of natural fields under that period conditions. The agricultural level of these environs was lower than the average in the whole large district of Utena (large fallow areas, rather low crop productivity).

During the Soviet period land ownership and its cultivation greatly changed. In the end of this period two big collective farms – those of Tauragnai (almost 7 thousand ha) and of T. Tilvytis (about 3.5 thousand ha), were in the present territory of Tauragnai *Seniūnija* (neighbourhood – a minor rural district, a part of *Valsčius*). The area of farming lands significantly decreased. That was caused by changed land ownership (state land ownership) and land cultivation (the application of big size agricultural machines, enlargement of lots, demographical changes).

After the restoration of Lithuania's independence (in 1990) essential changes take place again: the restoration of land private ownership rights and the change of land–tenure forms. The land of these environs is not fertile, mostly elderly people live in the villages. That is why land cultivation intensity is not high. Much of former arable land is not cultivated. A part of it is being afforested. This tendency will survive in the future. It is still difficult, however, to forecast how the landscape of these environs will look like in several decades.

Kazlų Rūda sandy lands: origin and structure /*KAZLŲ RŪDA*

By Rimvydas Kunskas

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The plain of Užnemunė (beyond the Nemunas River) in its eastern part make up a compact sand landscape called after the Kazlų Rūda region that distinguishes itself by farming and ethnic peculiarity.

The relief lowers 30 m/25 km and the rivers flow south-west. There are characteristic large dune masses of several generations and swamps among the dunes.

The role of lineaments, straight lines, is rather vivid in the landscape structure. That is a primary indication of the earth entrails structure and tectonic breaks in the crystalline foundation lying in the depth of 1,200–1,400 m. The diagonal line direction predominates; the orthogonal, parallel direction is spread as well. The submergence of Lithuanian–Polish syneclise began in the Ordovician, it continued in the Silurian and finished in the Upper Devonian, when the earth entrails differentiated regionally. The decomposition was predetermined by the block system. The Upper Cretaceous sea transgression greatly influenced the foundation of Kazlų Rūda plain.

The left Prequaternary river net direction still remains a problem. Only double negative forms of different genesis can be seen: river valleys and eroded local lowlands; level structure is also vivid. The Prequaternary structure is reflected even in the relief elements formed by the last glaciations, e. g. in the crest of Veiveriai and in the old valley of Išlaužas which are not compact, multistrata and the work of more than one glaciations.

The post-sand loam stratum covering the plain is re-covered (decomposed) in its own way by 2 or 3 sand and gravel interlayers and make up the thickness of 60–80 m. The origin of Užnemunė plain aquaglacial (clay and sand) deposits is also rather problematic. So far the viewpoint dominated that they were the glacial lake sediments of the last degrading glacier, and the sands of Kazlų Rūda are deposited in the delta of the glacier's main water-way into that lake. The author introduces some hypothetic corrections: the limnoglacial clay deposits compact and divided into belts were settling in the subglacial lake, and the sand deposits with aleurite insertions were settling in the eastern part of the glacial lake due to hydrodynamic melting in summer. An important correction of the new model is the plasticity of

the ingression flat surface of low mineralicity and the possibility to turn into an ice shield over the plain lake. Not only hydrodynamic but also hydrochemical change of the lake predetermined often occurring sedimentation diatacticity and stratification.

The first generation of dune crests could originate from thick ice-floe and lump deposits left at the glacial lake and the late one, already from the Holocene beginning, the dry Boreal period. Aleurite intrusions into sands predetermined the formation of swamps. The relation of dune masses and swamps with ice blocks is shown by their rhombic (diamond-shaped) and rectangular form. Four larger marshlands should be picked out. The strata of bogs reach 7 m thickness (in the North–West part of the Ežerėlis and Žiemelis marshlands). Some marshes, e. g. those of Naudžiai coincide with the intersection of tectonic breakings.

The mineral limonite and marshy land ore deposits are characteristic of the swamps. The formation of Fe_20_3 in low-lying marshy lands and river valleys is almost everywhere present. The washing out of underground water iron is predetermined not only by carbon dioxide but also by organic acids, mostly acid swamp water. Thus, a rather clear syngenesis of ore deposits and marshy lands exists. The ore carrying out into marshes strengthened very much in the last climatic period – the Subatlantic period, especially during its historical part. The iron extraction from limonite, the blacksmith's work, the blacksmith's pond building became the most essential trade of river-side villages.

The author observes the thesis that the Sūduva culture of the Užnemunė plain is inherited from the ancient 2nd–13th centuries and the Crusaders' War didn't stop it.

Palaeogeography, geomorphology and geoheritage of Gelvonai environs

/GELVONAI

By Valentinas Baltrūnas and Bronislavas Karmaza

Geology and Geography Institute

A great geological and geomorphologycal variety predestined by the complex palaeogeographical development of the locality is characteristic of former Gelvonai *Valsčius*. The Neris and Šventoji inter-river surface geological structure and geomorphology are associated with the last glaciations of Baltic (Pomerania) stage glacier retreat during South and Middle Lithuanian phases. The available new territory research material allowed to characterize a greater number of distinctive geological-geomorphological complexes (micro-regions) which mostly predestined the size of locality's wood and swamp areas, the possibilities of agricultural cultivation, urbanization and mining. They are the Pabaiskas–Bagaslaviškis hilly moraine massif, the Sližiai–Gelvonai eroded and abraded moraine plateau, the Upninkai–Keižonys and Musninkai flat and rough limnoglacial plain, the Šventoji and Širvinta terraced valleys. So far only one geological, one hydrological, one hydrographic, one telmatological and two landscape scenery preserves are legalized in the environs of Gelvonai.

Geology and palaeogeography of Kartena environs /*KARTENA*

By Valentinas Baltrūnas and Violeta Pukelytė
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In the vicinities of Kartena Township the local inhabitants many years since had connection with geological environment, in particular providing building materials, drinking groundwater from springs and wells. Some geological objects were mythologized, used for cult, defensive and other needs. The district is characterized by the structure of the Earth's crust: all geological layers of our planet from the crystal basement at the depths of 2 km, stratified layers of different rocks with fossils of ancient organisms in Cambrian, Ordovician, Silurian, Devonian, Permian, Triassic, Jurassic, Cretaceous and Quaternary periods. The tectonic structure, with small deposits of petroleum and gas, is very complex. Larger resources of geothermal energy and drinking groundwater are known. The terrestrial surface, which is a consequence of last glacier activity, comprising effects of melted waters, present rivers and other geological factors, contains small deposits of peat, gravel and sand.

Land subsurface structure, development and resources of Gelvonai environs /*GELVONAI*

By Bronislavas Karmaza and Valentinas Baltrūnas
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Geology and mineral diggings of Gelvonai Township in the vicinities of Gelvonai Township showed that the local inhabitants long since had connection with geological environment, in particular by providing building materials, drinking ground water from springs and wells. Some geological objects were mythologized, used for cult, defensive and other needs. The district is characterized by the structure of the Earth's crust: all geological layers of our planet from the crystal basement that lies in the depth of 0.7 km, with stratified layers of different rocks containing fossils of ancient organisms in Cambrian, Ordovician, Silurian, Devonian, Jurassic, Cretaceous and Quaternary periods. The terrestrial surface, which is a consequence of activity of the last glacier by effects of melted waters, present rivers and other geological factors, contains small deposits of peat, gravel and sand.

Land subsurface structure and development of former Kvėdarna rural district /*KVĖDARNA*

By Zigmas Malinauskas

Geology and Geography Institute

The territory of Kvėdarna *Valsčius* (pre-war rural district) is well researched from the geological point of view because even 67 boreholes had been drilled in a little area. Besides, various other geological works had been carried out. At present its subsurface is investigated to more than 2 km depths.

According to the geological structure, the territory is localized at the western border of the East European platform, i. e. Šilalė branch of the Rietavas trough of the Baltic syneclise. A part of the upper crust is made up of crystalline basement rocks covered by 1,982–2,062 m thick sedimentary rocks.

The crystalline basement lies here at the depths from 1,785 to 2,061.58 m. It is formed of metamorphic and magmic rocks that had formed in the lower Proterozoic 2–1.5 billion years ago. A part of them formed in the depth of 23 km. From 2 to 1.8 billion years ago the *Valsčius* territory was a part of the ocean arc archipelago. In the end of the period the orogenesis began and the mountain height could reach 10 km then. From 1.5 to 0.5 billion years their erosion was going on and the depth rocks reached the surface. About 0.5 billion years ago, in the end of the Lower Cambrian, the earth crust began sinking again and the Baltic syneclise began forming.

The sedimentary cover of rocks above the crystalline basement is formed of the Palaeozoic, the Mezozoic and the Cenozoic rocks with great intervals between them. The rock formation is attributed to the Caledonian, the Hercynian and the Alpine tectonic epochs and tiers.

The Caledonian structural tier joins the Middle and the Upper Cambrian terrigenous formations, the Ordovician and the Silurian carbonates and the Lower Devonian terrigenous sediments formed in the marine basins of various depth 520–390 million years ago. The tectonic tier thickness reaches 903–1,234 m.

The Hercynian structural tier joins the terrigenous and calcareous sediments of the rest Devonian formed between 390–256 million years, mostly under marine and lagoon conditions. The total tectonic tier thickness is 637–982 m less than the Caledonian one.

The Alpine structural tier includes the saliferous and terrigenous sediments of the Upper Permian, the Lower Triassic, the Upper Jurassic and the Cretaceous formed under lagoon and marine conditions between 256–240, 159–144, 100–80 million years. The total tectonic tier thickness reaches 103–267 m.

The different structural tier thicknesses show that the earth crust was sinking most intensively and most constantly at the beginning of the Caledonian and the Hercynian. Later the territory became a dry land and short sinking intervals not once were changed by rising ones in the Alpine epoch. Since 80 million years the territory became a flat plain. The last tectonic complex is covered by 100–150 m thick glacial Quaternary formations. They are thicker in the eastern and central parts. The Qua-

ternary rocks lying at the surface are of very much mixed com-position. A greater part of the *Valsčius* area is covered by till and glaciofluvial sediments.

The relief type or genesis, as well as the relief form allow to single out 6 geomorphological micro-regions that belong to the West Žemaitija plateau and the Middle Žemaitija hills. They were formed by the last glaciation Baltic depression glacier in the Jurassic upper reaches, the Nemunas River lower reaches and the West Žemaitija ice lobes. The meridian direction stripy hills are most often associated with marginal formations of the retreating glacier lobes and tongues, whereas the lowlands show the depressions in which the glacier lay a bit longer. Individual crests are spread around them as well.

Two industrial peat-bogs, four gravel deposits, some well-fields of fresh, mineral and saline water, some resources of geothermal energy and promising oil structures are known in the Kvėdarna *Valsčius* territory.

Seredžius geological basement /*SEREDŽIUS*

By Algirdas Gaigalas
Vilnius University

There are three major parts in Seredžius earth entrails structure: (1) the Precambrian basement, (2) the Proterozoic and Mesozoic strata and (3) the Quaternary cover. A characteristic feature of the Quaternary structure is the domination of glacial deposits. The moraines of four glaciations that reached Lithuania have been found: one of them is related to the stages of Dainava, Žemaitija, and Medininkai, the second is the Nemunas, and the rest two are the Grūda and the Baltic. In Middle Lithuania and the Nemunas lower reaches, glacier's wedge of two ressesive phases of the Nemunas glacial period Baltic stage was found in a rock exposure at the Dubysa River. There are notable moraine strata formed of ground, internal and surface moraine facies. Intermoraine layers and groundwater accumulated in the Quaternary glacial sediment cover. The Prequarternary rock surface is influenced by erosion and exaration. Deeply cut-in and buried palaeovalleys having practical and theoretical importance are significant elements. In the absence of deeper bore-holes, only the Middle Devonian dolomite marls have been reached. The Permian system anhydrite and gypsum deposits, occurring comparatively not deeply and making up strata of several tens metres, are interesting from the practical point of view.

Papilė geological and geomorphological environment */PAPILĖ I*

By Algirdas Gaigalas
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Papilė and its surroundings have an exceptional importance in Lithuania. The Venta River rock exposures with the Jurassic strata are declared to be geological monuments. The fossil fauna found in them are kept and protected in various European palaeontological geological museums. The geological research history lasts for more than 175 years. The research results are generalized in the paper.

The oldest Jurassic and Triassic strata are overlaid by the Quaternary glacial sediments. The Nemunas glacial Grūda and Baltic stages moraines and their phase morainic strata that form the Venta middle reaches plain relief are widespread in the environs of Papilė. The drumlinization signs observed in it were linked with initial phases of the Baltic stage: East Lithuanian and South Lithuanian phase glacial morainal alluvial deposits overlaid the primary drumlinized surface. The collected geological material shows that the Nemunas glaciation Baltic stage glaciers came creeping to the Venta middle reaches from north-east forming an independent glacial tongue isolated from Middle Lithuania glacial "lobe".

The surroundings of Papilė are adjacent to a mining region. Clay is excavated for Akmenė cement plant in the Triassic widespread area, the quarry of Šaltiškiai. Iron sphaerosiderites and unique fossils, ammonites, are found in the Jurassic deposits. Sphaerosiderite ores are poor in iron and don't fit for metallurgy.

Petrographic composition of stone axes and hatchets preserved in Papilė */PAPILĖ I*

By Algirdas Gaigalas
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Nineteen stone implements, mostly axes and hatchets preserved in the museum of Papilė secondary school were researched petrographically, they belong to the Late Neolithic and Bronze Ages. The petrographic research data confirmed that varieties of resistant rocks – diabases, uralitic porphyries, gabbros, etc. – were used to make stone axes and hatchets. These rocks are found in the fields among boulders brought from Fenno-Scandia by continental glaciers in the past, in the Pleistocene. The petrographic composition of stone implements corresponds to that of surface boulders and pebbles. It is quite convincing that people used to gather the smaller boulders or pebbles spread in the fields for making stone axes and hatchets. Thus, a specific culture of their production that can be associated with the territory covered by the Scandinavian glaciation in the Pleistocene may be established; Lithuania gets into the area covered by the last glaciation.

Exposures at the rivers of Minija and Alantas /*KARTENA*

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The upper moraine cover laminated structure of Kartena environs was revealed after having carried out the textural, structural and petrographical research of glacial sediments in the Minija and the Alantas rock exposures. The moraines of the Grūda and the Baltic glaciations, of different stages and phases, occur in it, subsided by the glaciers that had separated from the main Baltic glacier stream and moved from the north-western part towards the south-eastern one. The moraine cover differs in colour and petrograhical composition of pebbles and gravel. Deglaciation on the plain took place, with the glacier being in an active state.

Quaternary cover and index boulders in Gelvonai environs /*GELVONAI*

By Algirdas Gaigalas
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The Quaternary sedimentary cover of Gelvonai environs was formed by the glacial activity of the Nemunas glaciation Baltic stage South Lithuanian phase. The deltaic sediments of fluvioglacial mixed grain-size composition are specific, they had formed after the breakthrough of glacial melting waters into the Širvintai–Musninkai ice lake.

After having carried out the petrographic analysis of gravel-pit sediments in Bagdyšiai and Zubeliai locations of Gelvonai environs it was established that the erratic material was brought by glaciers from south-west Finland, the Aland Islands and the northern part of the Central Baltic. More porphyric structure rocks are found in finer (pebbles) fractions, and they are rarer among big boulders.

Gelvonai church architectural petrography /*GELVONAI*

By Algirdas Gaigalas
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The masonry of Gelvonai church is built of local field stones – the Pleistocene glacier boulders. The petrographic analysis of little building blocks showed that fully crystalline rocks of deep intrusion and acidic composition – those of granite and rapakives – predominate in the composition of stones used for building the church. Gneiss is also abundant. The erratic rocks as it became clear after having established the most characteristic rocks were brought by the Nemunas glaciation Baltic stage glacier mostly

from the Aland Islands and south-west Finland during the phase of South Lithuania. The archaeological petrographic research data present valuable material for solving the Quaternary geological problems, reconstructing the glacier movement regional directions, establishing the erratic rock origin places, exposing the glacier dynamics, etc.

Tauragnai land subsurface */TAURAGNAI*

By Algirdas Gaigalas
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Three main earth entrails parts of Tauragnai environs are distinguished in the vertical direction: (1) Proterozoic and Archaeozoic crystalline foundation, (2) the thickness of Phanerozoic sedimentary rocks and (3) the Quaternary glacial sediments and sedimentary cover.

The useful minerals are gravel and gravel-sand deposits found in surface sediments. For the first time gold dust traces were found in the gravel-pit of Tauragnai. Fresh ground water accumulates in the intermoraine formations and post moraine rocks. The environs of Tauragnai were famous for their erratic boulder deposits. There are several boulders under protection considered to be natural monuments and two boulder accumulations are preserves. The land of Tauragnai distinguishes itself for its picturesque landscapes formed by glacial sediments.

Juodupė–Onuškis land subsurface structure and Tumasoniai magnetic anomaly */JUODUPĖ. ONUŠKIS*

By Jevlampijus Laškovas and Antanas Ražinskas

The magnetic anomaly of Tumasoniai was established by means of Juodupė–Onuškis land magnetometric research in 1935–1938. In 1949–1960 the gravimetric investigations were carried out. After World War II the borings of Butkūnai-241 (862.7 m), Garsenė-2, -2a (942.3 m) and tens of shallower boreholes were drilled.

The land geological cross-section is made up of the Palaeoproterozoic crystalline basement rocks and of the sediments lying over the Neoproterozoic Vendian, the Palaeozoic Cambrian, the Ordovician, the Silurian, the Devonian and the Cenozoic quartz. The magnetic anomaly of Tumasoniai is of 12 x 3 km area. The ore deposit in Garsenė-2a borehole is lying in the depth of 1,000.5–117.8 m. It is made up of quartz magnetite. The stratum thickness is 200 m. The iron quantity in it is 38.77–55.12%. The prognosticated resources are 2.16 billion tons. The Ordovician facies cross section is worth mentioning. Some of the strata complexes (suites, members) are called after the land place names (Armoniai, Juodupė, Vaidlėnai, Vyžūnai, Alksniai and others), they are recognized as stratotypes and introduced into the Baltic and European platform stratigraphic schemes.

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Jonas Šedys (born 13 September 1934 in Aleknai Village, Rokiškis District) Ph.D. in agronomy (1968), studied the problems of maize and fodder cereal selection, selected these plant varieties: armless brome grass (*Skalva*, *Barta*, *Galinda*), reed fescue grass (*Silis*, *Jotvingis*, *Navas*), orchard grass (*Dainava*), reed canary grass (*Alaušas*). The sorts *Galinda*, *Jotvingis*, *Navas* and *Dainava* are included into the list of plant varieties most suitable for cultivating in Lithuania.

In 1995 he has retired from the research and since 2002 is preparing the Lithuanian *Valsčiai* monograph series „Juodupė. Onuškis".

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