

*Paleogeografija*  
*Palaeogeography*

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## **Distribution of raw material for prehistoric flint artefacts in South Lithuania**

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### **INTRODUCTION**

The first Lithuanian postglacial (Late Palaeolite) inhabitants used flint for production of knives, burins, borers, scrapers, axes, arrowheads, etc. The network of finding sites of Palaeolithic and Mesolithic flint artefacts almost coincides with the distribution of flint concretions (nodules) in the Upper Cretaceous carbonaceous rocks (Skuodienė, Katinas, 1981).

The available scanty research material on siliceous rocks in Lithuania allows to observe some distribution patterns of siliceous artefacts and to formulate a working hypothesis about the ancient local sources of the raw material of archaeological flint artefacts. Based on geochemical data analysis, the sites and archaeological monuments were hierarchically classified (Karmaza et al., 2001). The dendrogram of cluster analysis based on the data of spectrophotometric analysis has revealed that the artefacts often come from remote objects and archaeological monuments of different age (Paleolithic,

Mesolithic and Neolithic). Grey gaize and its strongly silicified varieties sometimes referred to as flint attracted attention when studying the evolution of the cultural landscape of the Žemaičiai Upland. These flint artefacts are related with the erosion relicts of the Late Cretaceous Campanian rocks in the sub-Quaternary surface, which were used as a tool material in the Stone Age (Baltrūnas et al., 2004).

The goal of the project and all the work in 2005 was to establish the distribution, composition, origin and possible directions of transportation of prehistoric siliceous (flint) artefacts in Lithuania (Baltrūnas et al., 2006). For revealing the distinctions in the composition of siliceous rocks and the distribution of major and trace elements, the samples were analysed by Direct Current Arc Emission Spectrophotometry. The data processing by statistical methods (correlation and cluster analysis) allowed to draw a conclusion that siliceous artefacts could belong to three genetic types of raw material.

E. Kalechits (1984) has studied the use of resources of siliceous rocks in prehistoric times and their distribution in the territory of Belarus. V. Petrun (Petrun, 1971; Bruyako et al., 2005) has thoroughly studied flint artefacts in Ukraine. He managed to distinguish two types of flint (from the Prut and Dnestr basins) spread in the territory of Ukraine. Thanks to him, it is possible today to relate archaeological artefacts with different sources of raw material and to follow up the main routes of this raw material in the prehistoric times. As far back as 1970, 16 finding sites of flint artefacts were identified in the Upper Volga Valdai Uplands (Selivanova, 1984; Sinitsina, 2005). V. Galibin and V. Timofeyev (1993) carried out mass spectrometric analysis of uncovered artefacts, allowing a precise characteristic of the geochemical composition of flints from each finding site. Methods of geochemical identification of each group of flints were worked out on the ground of this analysis. J. Kozłowski and other (1981), M. Kaczanowska (1986), B. Balcer (1988), M. Kobusiewicz (1997) and others described the main centres of flint industry and directions of flint artefact distribution in Poland. Similar research is carried out in other European countries: J. Konda (1986), E. Bácskay (1984), Biró K. (1997), J. Hoika (1986), A. Binsteiner (2004), C. Becker (1959), L. Nielsen (1997), and other (Elburg & Kroft, <http://www.flintsource.net>).

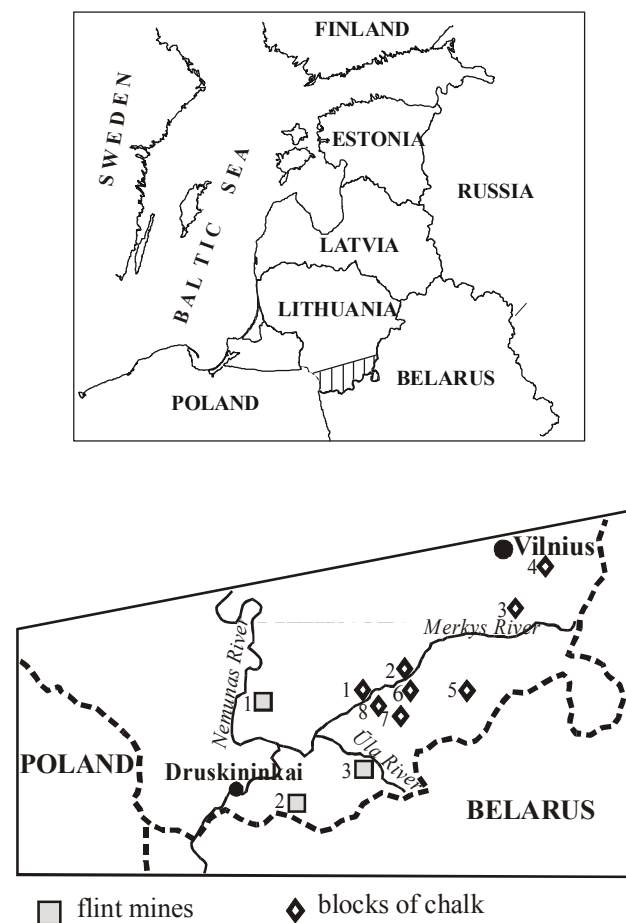
The main aim of this publication is to determine the spread and genesis of the raw material of prehistoric flint artefacts in South Lithuania. The main task is to evaluate the dependence of the spread of the raw material of flint artefacts on chalk blocks *not in situ* and their washout residuals in the region and their exploitation conditions (Fig. 1).

## METHODS

The geological and geomorphological regionalization maps (scale 1:200 000) and numerous investigations of discrete geological objects (their results are published in other works: Baltrūnas, 2001; etc.) lay at the basis of factual material for compilation of paleogeographical maps at a scale of 1:200 000. The conclusions of the mentioned investigations served as a theoretical and conceptual basis. The subdivision and correlation of the strata were based on traditional biostratigraphical and lithostratigraphical criteria (Gaigalas, 1995; Baltrūnas, 1995; etc.). The study was accomplished in a few stages: 1 – analysis of the archival and printed material on the spread, composition and genesis of chalk blocks and flint concretions (nodules) in Lithuania and neighbouring countries and its systematization; 2 – revision of Stone Age flint artefacts stored at museums; 3 – field works in South Lithuanian sites known for chalk blocks and flint artefacts. Laboratory work and statistical and graphical generalization of the obtained geochemical data are reported in another publication (Baltrūnas et al., 2006).

## DISTRIBUTION OF PRE-QUATERNARY ROCK BLOCKS IN SOUTH LITHUANIA

The distribution of the study objects depended on the peculiarities of geomorphological regions and geological structure of sub-Quaternary surface and Quaternary deposits (Dalinkevičius, 1963; Vaitiekūnas, 1962; Baltrūnas, 1995, 2002; Guobytė, 2001; Lietuvos Žemės gelmių..., 2004). The sub-Quaternary surface lying at a depth of 260 m (mainly 50–150 m) is composed of Neogene, Paleogene, Cretaceous, Jurassic, Triassic and Permian rocks. There are few sites in South Lithuania with *in situ* lying Cretaceous rocks (at Skirsnemunė and Marvelė outcrops by the Nemunas River, Rokai by the Jiesia River).



**Fig. 1.** Investigation sites of marl blocks and prehistoric flint mines in South Lithuania.

Chalk blocks: 1 – Akmuo, 2 – Kuktiškės, 3 – Juodžiai, 4 – Naujoji Vilnia, 5 – Tetėnai, 6 – Mielupis, 7 – Šarkiškės, 8 – Matuizos. Flint mines: 1 – Ežerynai, 2 – Margionys, 3 – Titnas

**1 pav.** Kreidos lūstų ir priešistorinių titnago kasyklų tyrimo vietos Pietų Lietuvoje.

Kreidos lūstai: 1 – Akmuo, 2 – Kuktiškės, 3 – Juodžiai, 4 – Naujoji Vilnia, 5 – Tetėnai, 6 – Mielupis, 7 – Šarkiškės, 8 – Matuizos. Titnago kasyklos: 1 – Ežerynai, 2 – Margionys, 3 – Titnas.

Blocks of sub-Quaternary surface rocks occur quite frequently in Lithuania. They are found in the outcrops of the Nemunas River near Alytus and Druskininkai (Paleogene rocks), of the Lower Šventoji, Lower Merkys, in the basin of the Šešupė River (Cretaceous and Jurassic rocks), south-eastwards from Vilnius (Cretaceous rocks). Most of the above-mentioned blocks are found in an old valley segment in the Merkys River valley between Varėna and Pamerkiai. The depth of block occurrence differs: from visible in outcrops to the depth of 150–180 m. Their thickness reaches 20–40 m. In some borings, 5–6 large blocks of the total thickness 75–85 m (boring No. 480 near Akmuo village, etc.) are found (Fig. 2). The area of blocks reaches 50 ha and their volume is up to 10 million m<sup>3</sup>. According to the mode of occurrence, the blocks of Pre-Quaternary rocks are of two types. Some blocks occur in paleoincisions or near the sub-Quaternary surface and are local. Most often they are Upper Cretaceous carbonates (chalk, marl). Other blocks are connected with the upper part of Pleistocene strata. They are the Upper and Lower Cretaceous and Upper Jurassic rocks. The process of block formation and assimilation undoubtedly contributed to the heterogeneity and multinomiality of tills. In the unturned blocks, the Upper Jurassic rocks formed of black argillaceous sand and silt and even their contacts with Lower Cretaceous glauconitic sand are found. On the territory under investigation, naturally occurring Upper Jurassic deposits are absent. Lithological and geochemical investigations of Lower Cretaceous glauconitic deposits from blocks have revealed their greater resemblance to analogous deposits in the Nemunas River zone than to the local ones on the sub-Quaternary surface. Thus, the available material indicates that the blocks have been transported at least to a distance of 30–50 km. They

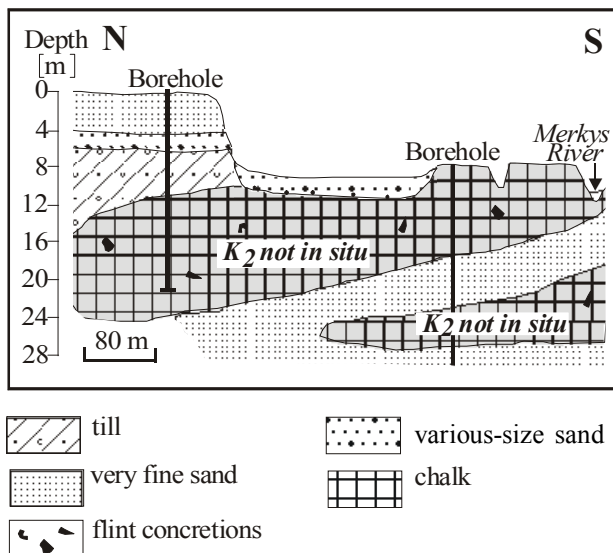


Fig. 2. Geological cross-section of chalk blocks in Akmuo village (see in Fig. 1)

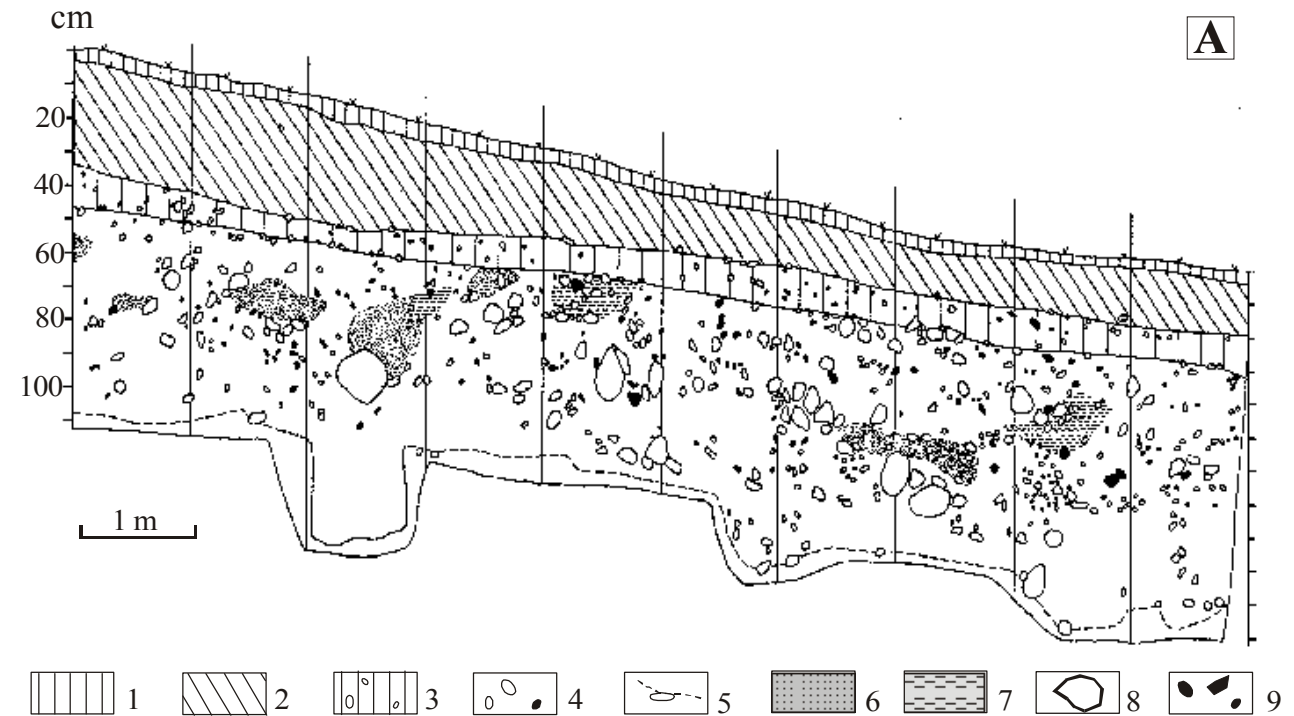
2 pav. Kreidos luistų geologinis pjūvis Akmens kaime (žr. 1 pav.)

have been reduced to smaller ones by a peculiar way of “stretching”. The final phase of such an assimilation has survived in the outcrop of the Merkys River near the Akmuo village (Varėna district).

The Margionys area lies in the southern periphery of Lithuania in the sandy South-Eastern (Dainava) Plain which is the spread area of glaciofluvial sediments (Baltrūnas, 2001). The Margionys sandur left by the last glaciation is composed of poorly sorted gravel with coarse pebble and scanty boulders up to 0.6 m in diameter. It contains many flint concretions and debris. Flint fragments also abound on the surface. Dune massifs are widespread east, north and west of the sandur. They developed because of the reworking of fine glaciolacustrine sand during the Late Glacial and the beginning of the Holocene. According to data of Margionys borehole No. 357, the thickness of Quaternary sediments in this locality reaches 183.5 m. The thickness is smaller (120–100 m) east and west of the locality. This sediment complex is overlying the Campanian carbonaceous rocks (chalk, chalk marl, etc.) of the Upper Cretaceous. It is composed of till layers left by the Middle Pleistocene glaciations and interstratified interglacial lacustrine sediments of Butėnai (Holsteinian) Interglacial. Carbonaceous Campanian rocks are widespread north and east of Margionys. Carbonaceous and terrigenous rocks of the Coniacian and Cenomanian stages and glauconite sand of the Lower Cretaceous are exposed in paleoincisions. The elevations of sub-Quaternary surface west of Margionys are composed of the Upper Paleogene sands, sandstone, silt and marl with rare interlayers of gaize. The *in situ* carbonaceous Cretaceous sediments are exposed only further south of Margionys (Grodno District of Belarus). Neolithic and Bronze Age flint mines are known in the western part of Grodno District. Flint artefacts might have been transported from this locality to the neighbouring countries (Archaeology..., 1993; Quaternary..., 1997).

## ARCHAEOLOGICAL DATA

Lithuanian archaeologists have investigated three of four known prehistoric complexes of the flint mining and processing areas: in Ežerynai (Alytus District) (Jablonskytė-Rimantienė, 1966; Rimantiene, 1984), environs of Lake Titnas (Varėna District) (Šatavičius, 2002) and Margionys village (Varėna District) (Ostrauskas, 2000) (Fig. 1). Prehistoric miners had extracted flint concretions from chalk washed up by melting ice water and chalk with pebbles or pebbles with gravel layers in all three areas of mines. Flint raw materials were exploited in Ežerynai flint mines mostly during the Final Palaeolithic (10th–9th c. BC). This area was used by Baltic Magdalenian Culture groups during the Allerød and the beginning of the Younger Dryas, and by various groups of Swidrian Culture groups during the Younger Dryas. People excavated pits in gravel and extracted flint concretions from it on the upper terrace of the Nemunas River in Ežerynai.



**Fig. 3.** Flint mines and workshops in Margionys village

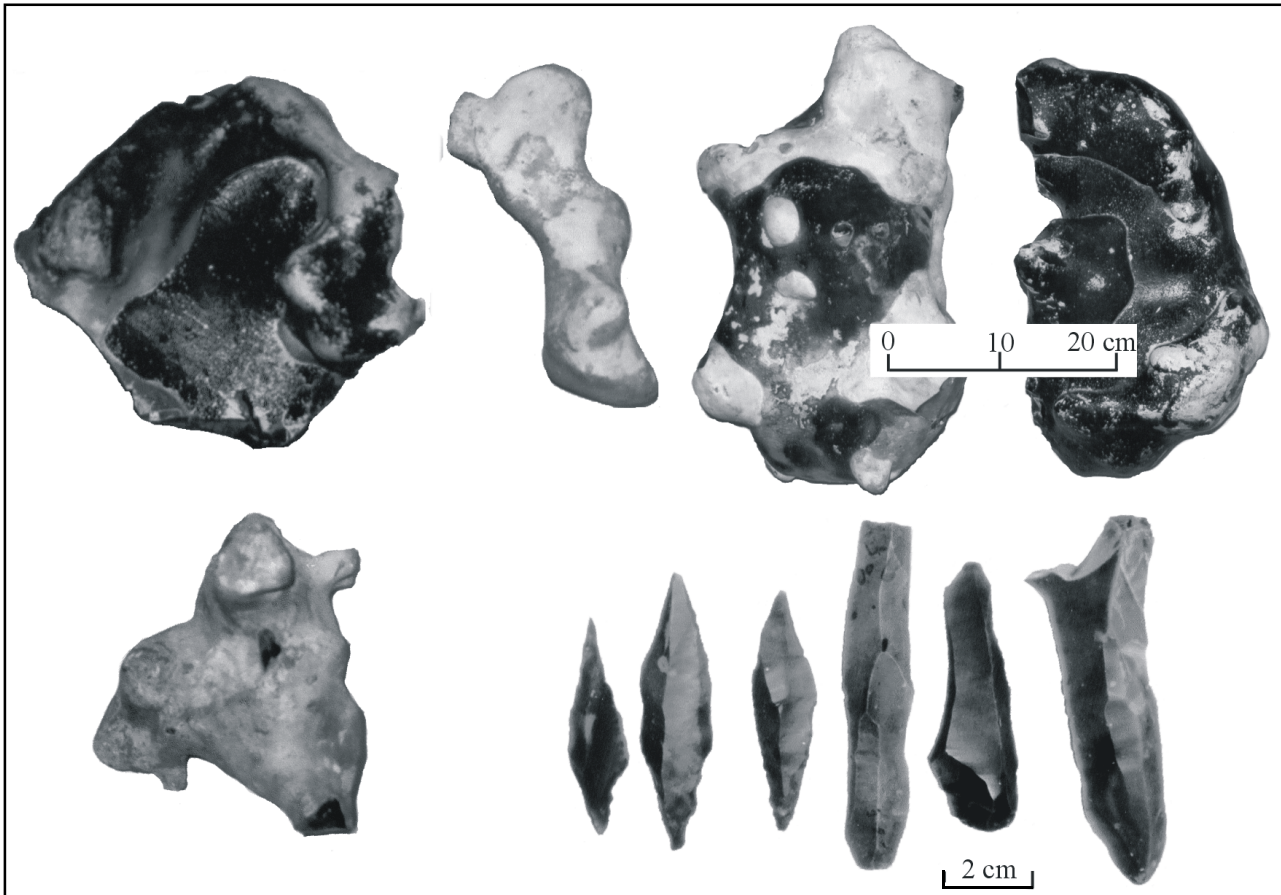
**A** – cross-section of test trench: 1 – upper soil; 2 – aeolian sand; 3 – dark greyish soil; 4 – cultural layer – brown gravel with pebbles, flint nodules and debris; 5 – white gravel with sand and low limit of cultural layer; 6 – powdery various-grand sand; 7 – old soils – black gravel; 8 – stones; 9 – flint nodules and chipped pieces;

**B** – investigation trench; **C** – geomorphological situation.

**3 pav.** Titnago kasybos ir apdirbimo vieta Margionių kaime

**A** – tirtos tranšėjos pjūvis: 1 – viršutinis dirvožemis, 2 – eolinis (supuštintas) smėlis, 3 – tamsiai pilkas dirvožemis, 4 – kultūrinis sluoksnis – rudas žvirgždas su gargždu, titnago gniutulai ir nuolaužos, 5 – baltas žvirgždas su smėliu ir kultūrinio sluoksnio apatinė riba, 6 – birus stambiagrūdis smėlis, 7 – senas dirvožemis – juodas žvirgždas, 8 – akmenys, 9 – titnago gniutulai ir trupinimo nuolaužos;

**B** – tirtoji tranšėja; **C** – geomorfologinė situacija.



**Fig. 4.** Flint concretions and flint artefacts from Margionys mining and processing area  
**4 pav.** Titnago konkretijos ir titnago dirbiniai iš Margionių kasybos bei apdirbimo vietos

The Lake Titnas flint mining area is investigated to a less degree. The investigated test pits have shown that flint concretions are found mostly in washed up chalk layers. Flint sources from Lake Titnas banks were intensively used by final palaeolithic Swidrian Culture, but some finds from surface survey reveal-ed mining activity in Titnas environs during younger periods of the Stone Age and possibly the Bronze Age as well.

The Margionys flint mining and processing area covers an area of more than  $800 \times 300$  m (Figs. 3, 4). Flint concretions (nodules) here were dug out of the upper terrace of the Skroblus River from chalk with pebbles or pebbles with gravel layers washed up by melting ice-sheet waters. Chalk layers with flint concretions (nodules) lie only 0.4–0.5 m from the ground surface in some cases. Flint concretions were extracted from gravel with pebbles from a depth of more than 2 meters in other cases. A fragment of a long bone of a big animal, which probably had been used for digging, was found in the deepest pit. This bone find was dated by  $C^{14}$  to 3770+/-80 BC (Ki-9464). Prehistoric mines were used by South Lithuanian population starting from the Final Palaeolithic until the Late Bronze or even the Early Iron Age (9th–1st mill. BC). The mining activity of Svidrian Culture was identified here during the Final Palaeolithic (9th mill. BC), Kudlayevka Culture during

the Early Mesolithic (8th mill. BC), Janislawice Culture during the Late Mesolithic and the Early Neolithic (end of the 7th – 5th mill. BC). Huge amounts of debris from production of bifaces (a bank of a sickle) and damaged half-finished bifaces and axes in some parts of Margionys flint mines revealed flint exploitation during the Bronze Age and possibly the Early Iron Age (2nd–1st mill. BC).

## CONCLUSIONS

1. Flint concretions in Lithuania are associated with Cretaceous carbonaceous flint outcrops and especially with chalk and chalk marl blocks transported by glaciers and their washout residuals in South Lithuania. The blocks of Pre-Quaternary rocks occur quite frequently in South Lithuania. They are found in the outcrops of the Nemunas River near Alytus and Druskininkai (Paleogene rocks), of the Lower Šventoji, Lower Merkys, in the basin of the Šešupė River (Cretaceous and Jurassic rocks), south-eastwards from Vilnius (Cretaceous sand). Most of the above-mentioned blocks are found in an old valley segment of the Merkys River valley between Varėna and Pamerkiai.

2. Prehistoric mines were used by South Lithuanian population starting from the Final Palaeolithic until the

Late Bronze or even the Early Iron Age (9th – 1st mill. BC). Mining activity of Svidrian Culture was identified here during the Final Palaeolithic (9th mill. BC), Kudlayevka Culture during the Early Mesolithic (8th mill. BC), Janislawice Culture during the Late Mesolithic and the Early Neolithic (end of 7th – 5th mill. BC). Huge amounts of debris from production of bifaces (a bank of a sickle) and damaged half-finished bifaces and axes in some parts of Margionys flint mines revealed flint exploitation during the Bronze Age and possibly the Early Iron Age (2nd – 1st mill. BC).

3. The accomplished work and its results are important for the further cooperation of geoscientists and archaeologists applying geological and archaeological methods for studying the economic, social and cultural processes in the prehistoric times. In general, the present work launches studies of flint as a raw material of the prehistoric artefacts in Lithuania, which until present bore a sporadic character.

#### ACKNOWLEDGEMENTS

The authors thank the Lithuanian State Science and Studies Foundation for support of the project (Reg. No T-05044). The authors are also grateful to Assoc Prof. Dr. P. Šinkūnas for consultation, to D. Ostrauskienė from the Lithuanian National Museum and B. Poškienė from the Geological Museum of the Institute of Geology and Geography for permission to use collection material.

Received 30 09 2006

Accepted 16 10 2006

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#### **PRIEŠISTORINIŲ TITNAGO DIRBINIŲ ŽALIAVOS PAPLITIMAS PIETŲ LIETUVOJE**

##### **S a n t r a u k a**

Atlikto darbo tikslas – nustatyti priešistorinių titnago dirbinių žaliavos paplitimo ir genezės ypatybes Pietų Lietuvoje įvertinant titnago dirbinių žaliavos paplitimo priklausomybę nuo titnagingos kreidos luistų paplitimo regione, taip pat jos eksploatavimo sąlygas konkrečiose akmens amžiaus kasyklose. Tam peržiūrėta archyvinė ir literatūrinė medžiaga apie titnagų sudėtį, genezę ir paplitimą Lietuvos ikikvarterinių uolienų sluoksniuose, taip pat kreidos periodo titnagingų karbonatinių uolienų (kreidos, mergelio) glacigeninės kilmės luistų paplitimą. Didžiausi luistai rasti prie Juodžių, Tetėnų, Kuktiškių, Mielupio, Šarkiškių, Matuizų, Akmens kaimų. Archeologinių tyrimų pagrindu yra nustatyti trys priešistorinių titnago kasyklų ir dirbtuvių kompleksai: Ežerynuose (Alytaus r.), Margionių kaime ir prie Titno ežero (Varėnos r.). Pateikiama ir aptariama nuodugniau tirta Margionių komplekso geologinė, geomorfologinė ir archeologinė medžiaga, liudijanti, kad titnago kasykla buvo eksploatuojama nuo vėlyvojo paleolito iki žalvario amžiaus. Manoma, kad kompleksinis paleogeografinių, sedimentologinių ir geomorfologinių tyrimų taikymas archeologiniuose darbuose padės vertinant akmens amžiaus ekonominius, socialinius ir kultūrinius procesus.