



since 1961

Baltica

BALTICA Volume 36 Number 1 June 2023: 30–36

<https://doi.org/10.5200/baltica.2023.1.3>

Geological map of Antony Karol Giedroyc of the territory of Lithuania in the context of geological cartography of the 19th century

Jonas Satkūnas*, Gailė Žalūdienė

Satkūnas, J., Žalūdienė, G. 2023. Geological map of Antony Karol Giedroyc of the territory of Lithuania in the context of geological cartography of the 19th century. *Baltica*, 36 (1), 30–36. Vilnius. ISSN0067-3064.


Manuscript submitted 2 January 2023 / Accepted 24 March 2023 / Available online 15 May 2023

© Baltica 2023

Abstract. The history of geological cartography of the present territory of Lithuania starts with a map published by Jean Etienne Guettard in 1764 and followed by maps by Stanisław Staszic in 1806, Ignacy Domeyko in 1837, and Frederic Dubois de Montpereaux in 1830. A new period of investigations and compilation of geological maps starts about 1840 and is closely related with the development of stratigraphic knowledge; therefore, this period marks the beginning of mapping using the stratigraphic concept (Helmersen 1841). The Geological Committee in St. Petersburg, founded in 1882, at the very beginning of its activities started the compilation of a geological map including the present territory of Lithuania. The works of Antony Karol Giedroyc (Antanas Karolis Giedraitis) were published in 1895 (Giedroyc 1895), and the volume included a map which displays the occurrences of Quaternary and Pre-Quaternary (Tertiary, Cretaceous, and Jurassic) sediments and rocks. The map is constructed on the basis of direct observations and descriptions of outcrops and exposures of Quaternary sediments and Pre-Quaternary rocks carried out by the author, also based on evidence by local people. The main occurrences (provinces) of Pre-Quaternary rocks mapped by Giedroyc are confirmed by the modern geological mapping of the 20th century; therefore, the map of Giedroyc (1895) is regarded as a pioneering work of modern geological mapping using international stratigraphic standards.

Keywords: *Pre-Quaternary; Quaternary; history of geological science; stratigraphic concept*

✉ Jonas Satkūnas* (jonas.satkunas@igt.lt),

Gailė Žalūdienė (gaile.zaludiene@gamtc.lt),  <https://orcid.org/0000-0003-3638-8388>

Nature Research Centre, Akademijos 2, LT-08412, Vilnius, Lithuania

*Corresponding author

INTRODUCTION

The progress of geological mapping and the contents of geological maps represent the level of geosciences at any given time rather exactly (Breznsky, Turczi 1998). If the first maps showed the distribution of the occurrence of rocks and mineral deposits only, more modern ones incorporated stratigraphic concepts and with the help of colours and other signs depicted the order of sediments according to their geological age. The geological mapping of the present territory of Lithuania has a long history, which is discussed in a number of papers (Grigelis *et al.* 1981; Satkūnas *et al.* 2006; Žalūdienė 2006; Satkūnas, Žalūdienė 2007). This paper aims to dis-

cuss the map of Antony Karol Giedroyc (Antanas Karolis Giedraitis) published in 1895, its contents and methodology of compilation, possible relationship with former maps, and its value in the context of geological cartography of the 19th century. It is assumed that the mapping endeavour carried out by Giedroyc significantly contributed to the development of modern concepts of understanding of Pre-Quaternary and Quaternary geology of Lithuania and adjacent territories.

MATERIALS AND METHODS

The object of this study is the map of Giedroyc of 1895, which originally comprises a vast territory of

the present Belarus, Poland and Lithuania, whereas the Lithuanian part covers about the fourth (north-western) part of the map. The map is at a scale of 1: 420,000 (Baltrūnas, Pukelytė 2021). This map is included in an extensive study (Giedroyc 1895), the contents of which as well as the mentioned map are discussed in a number of papers (Dalinkevičius *et al.* 1969; Grigelis *et al.* 1981; Paškevičius 2010; Žalūdienė 2018; Baltrūnas, Pukelytė 2021). In this paper, we analyze in particular the methodology and concept of the compilation of the map by Giedroyc 1895 from the point of view of: a) cartography of the 19th century and b) present-day geological cartography.

It has to be noted that the geological cartography of the 18–19th centuries is considered in this paper only to the extent of the works which cover the part of Lithuania mapped by Giedroyc (1895). Other mapping products covering Latvia and northern or western part of Lithuania are not analyzed in this paper.

DISCUSSION

Beginning of the history of geological cartography

The first fact of the geognostic cartography of Lithuania is a map with geological information which was compiled and published by Jean Etienne Guettard (1715–1786) in 1764. This map is regarded as the oldest map of the geological contents of the present Polish and Lithuanian territories, which made an outstanding contribution to the geological cartography of Europe, France in particular (Fleszarowa 1962; Tarkowski 2005). The map was printed in the volume of the *Histoire de l'Académie Royale des Sciences à Paris* and was entitled *Carte minéralogique de la Pologne. Relative à un mémoire de M. Guettard* (Fleszarowa 1962). The map is black and white and shows four mineralogical (geological) zones. Evidently, this map was not very informative. For example, the whole territory of Lithuania was simply depicted in the “sandy zone”, which comprised two thirds of the map. There is no evidence what data were used by Guettard to make such cartographic image of the “sandy zone”. Nevertheless, this was the first example of geoscientific cartography of the territory under discussion.

The next historical fact in geological cartography is a geological map compiled by Polish geologist and geographer as well as social and political activist Stanisław Staszic (1755–1826) in 1806 (Žalūdienė 2006). This map was at that time very informative not only from the geological but also from the hydrographical point of view. The map was originally printed on 44 folio sheets, the size of individual sheets

of the map is 66 × 47.5 cm, with a scale of approximately 1:1 250 000. It covers Poland, Moldova, Transilvania, part of Hungary and Valachia. Six geological formations are depicted using different colours (Staszic 1806). These formations have structural and stratigraphical meanings: *Montagne Primitive* (Precambrian), *Montagne secondaire première stratiforme* (Lower Palaeozoic), *Montagne Antemarine* (Palaeozoic, Mesozoic), *Montagne Marine* (Tertiary), and *Ferresd'alluviam* (Quaternary). This subdivision is characteristic of the Wernerian neptunist theory, prevailing in geology at the beginning of the 19th century. Additionally, types of rock – granites, gneisses, porphyries, gypsum, etc. – are indicated by figures according to the legend. The map was later published by S. Staszic in his book “On the earth-formation of the Karpaty Mountains and other mountains and plains of Poland” (Staszic 1815) (in Polish). A copy of this map is available at the Department of Geology and Mineralogy of Vilnius University (Žalūdienė 2006).

One more cartographic work reflecting some features of geological structure of the Baltic region was published in 1822. It was a geognostic sketch elaborated by William Thomas Horner Fox-Strangways (1795–1865) for “An Outline of the Geology of Russia”. This sketch covers the present territory of Curonia, Estonia, northern Latvia and European part of Russia (Russian plate).

The first research – geognostic expeditions – in the territory of Lithuania were organised only in the third decade of the 19th century (Satkūnas, Žalūdienė 2007). In 1825, researchers Vasilij M. Severgin (1765–1826) and Jan von Ulman provided a geognostic overview of Vilnius, Minsk, and Grodno gubernates. The report described the outcrops of limestone and iron ore in Papilė and gypsum layers in the vicinities of Pasvalys and Biržai (Ulman 1827); however, no geological discoveries of outcrops were reported from the eastern Lithuania. In 1826, a team led by Leopold von Buch (1774–1853) published the *Geognostische Karte von Deutschland...* It was perhaps the first series of geological maps in the world. These are 42 separate sheets; the scale is close to 1:1,000,000. The maps represent the part of Europe from Paris and Clermont-Ferrand in the west to Klaipėda (Memel) in the east and Turin in the south (Wołkovicz, Wołkovicz 2014). This is probably the first modern geological map that included the territory of Lithuania (Buch 1826). Geognostic expeditions were organised in the territory of Lithuania and adjacent areas in several later years by Vansovich and Leman (1826) (Vansovich 1927), Karl Eduard von Eichwald (1830); however, these investigations were not included in regional cartographic works (Eichwald 1830; Grigelis *et al.* 1981).

In 1830, naturalist and researcher of geology Frederic Dubois de Montpereaux (1798–1850) published a geognostic map of Lithuania and southern Latvia (scale 1: 1,800,000) (Dubois 1830). The map was supplemented by an explanatory article describing mineral resources of the area depicted on the map. The map was coloured and displayed occurrences of limestone, tufa, clay, and gypsum. In eastern Lithuania, only a few spots of clays were depicted, and it is assumed that these clays are Quaternary glacial or glaciolacustrine deposits.

About 1837, Ignacy Domeyko (1802–1889) completed four maps of Poland and Lithuanian territories, which depicted water, earth, forest, and the political situation. These maps were published in 1850 in the *Atlas de l'ancienne Pologne* (Dufour, Wrotnowski 1850). The geological map ('Earth') was compiled on a scale of 1:3,500,000 (Chałubińska 1961, 1962). The hydrographic map was used as a base map. The legend has nineteen colours, each indicating a different type of geological formation, identified by lithological properties or characteristics (Graniczny *et al.* 2002). Domeyko used Fox-Strangways' map, although in the reference to the areas marked in blue (sandstones, marls and gypsum of recent sediments) he refers to the descriptions by Georg Gottlieb Pusch (1790–1846), contained in his two-volume work "Geognostische Beschreibung von Polen" (1833 and 1836) (Wołkowicz, Wołkowicz 2021).

The geological map made by Domeyko is amongst the pioneer works not only for Poland and Lithuania but also for Europe more widely, and it is one of the most important studies of this type. Domeyko is the first geologist who did the morphographic and geological zonation of Lithuania (Gaigalas 2002).

The period of investigations and compilation of geological maps starting in about 1840 is closely related with the development of stratigraphic knowledge, and therefore this period marks the beginning of mapping based on the stratigraphic concept. However, in this period geological investigations in the territory of Lithuania still were fragmentary and discontinuous, carried out by single researchers mainly from universities of Warsaw, Kenigsberg, Tartu, St. Petersburg and elsewhere.

In 1841, Gregor von Helmersen compiled a map of European Russia, in which on the basis of palaeontological data by Eichwald and Leopold von Buch he indicated the Devonian system in north Lithuania and Cretaceous and Tertiary rocks in the south, in the vicinities of Grodno (Helmersen 1841). It was the best map at that time compiled according to the stratigraphic principle (Žalūdienė 2006).

In 1845, Roderick Murchison, Edouard de Verneuil and Alexander von Keyserling published a two-volume book entitled "The Geology of Russia in

Europe and the Ural Mountains", which reports on the results of two field seasons in Russia and current territory of Lithuania (1840 and 1841) (Grigelis *et al.* 1981; Murchison *et al.* 1845). In this first coloured geognostic map of this area, scale of ~ 1: 5,000,000, the researchers depicted Silurian, Devonian, Carboniferous, Permian, Jurassic, and Cretaceous sediments.

An outstanding contribution to geological cartography was done by Konstantin Grewingk (1819–1887). The first work of Grewingk was published in 1857, in which he subdivided the Devonian of Lithuania and Latvia into three stages. On the basis of palaeontological and structural data, in 1861 he composed a geological map at a scale of 1:1,200,000, which quite in detail reflected the main features of geological structure on the main part of Latvia and northern Lithuania. In 1879, Grewingk published the second map at a scale of 1:600,000 with an extensive explanatory text. In this map, first at all the areas of Permian and Triassic rocks and Cretaceous outcrops (in the Kaunas vicinities) were indicated (Grigelis *et al.* 1981). It has to be noted that in this period some researchers were already trying to compile maps contain palaeogeographic information and covering the whole European part of Russia or even the whole Europe (Žalūdienė 2006). For example, a very extensive Devonian belt was assumed by Stepan Kutorga (1805–1861) in his sketch map of 1858.

A valuable input to stratigraphy of the Baltic region belongs to Józef Siemiradzki (1858–1933) and Emil Habdank-Dunikowski (1855–1924) (Siemiradzki, Habdank-Dunikowski 1891). In their geological overview of Poland and adjacent areas, there is presented a description of Devonian, Permian, Jurassic, Cretaceous, Triassic, and Quaternary. It was a modern work for the time, a cartographic synthesis covering the area from the Carpathians to the Gulf of Riga (Graniczny *et al.* 2008).

The foundation of the Geological Committee in St. Petersburg in 1882 must be noted as a very important fact in relationship to the development of geological cartography. At the very beginning of its activities, the Committee undertook a task of compiling a geological map at a scale of 1:82,400 for the whole territory of Russia. Due to the accomplishment of this task in the present territory of Lithuania, Antony Karol Giedroyc (Antanas Karolis Giedraitis), Anna Misuna, and Czesław Chmielewski (1867–1921) significantly contributed to the development of geological cartography.

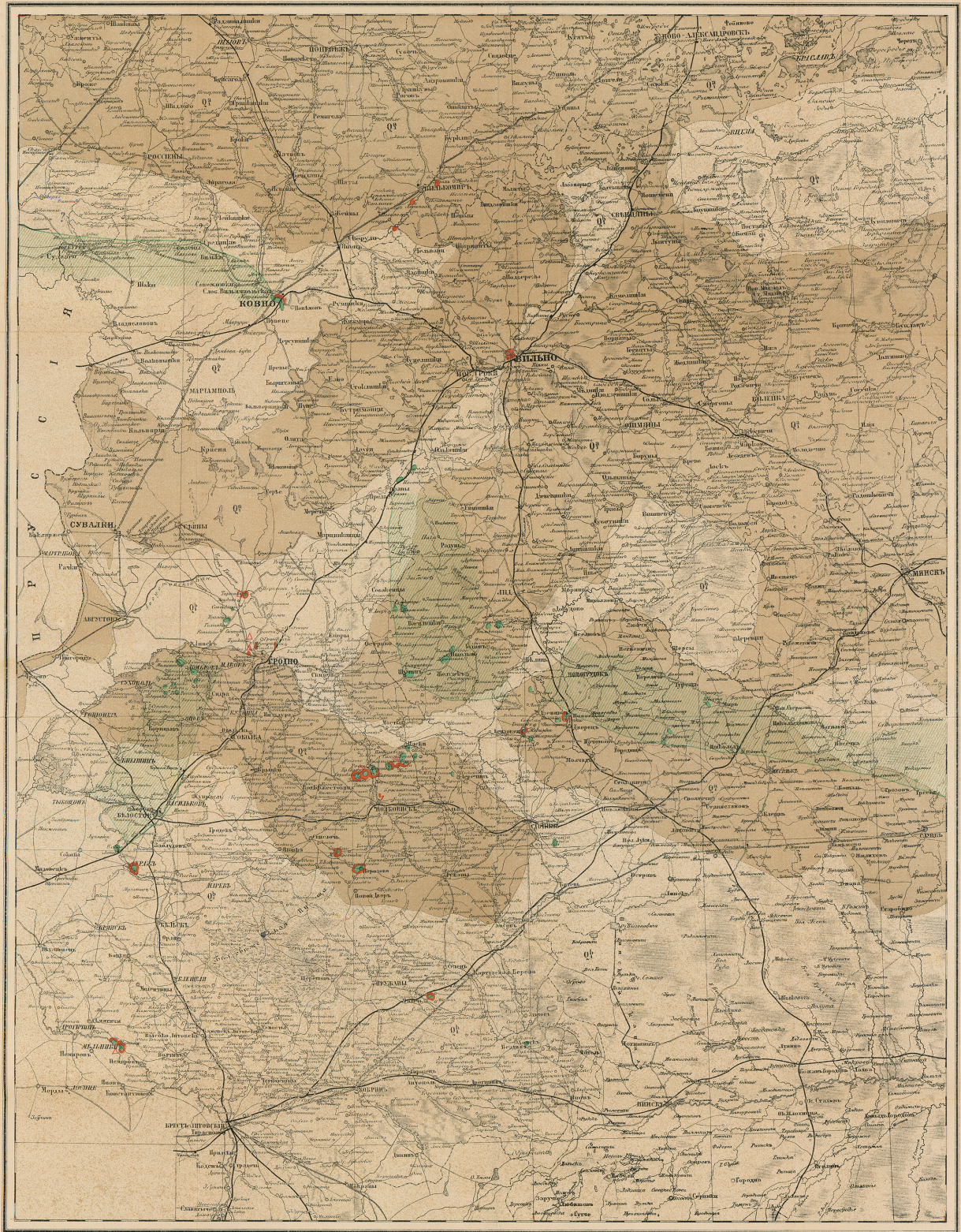
The map of Antony Karol Giedroyc (1895)

The geologist and duke of Lithuanian origin Antony Karol Giedroyc (1848–1909) carried out geological investigations in eastern Lithuania and western Belarus in the period 1878–1887 (Dalinkevičius *et*

ГЕОЛОГИЧЕСКАЯ КАРТА
ВИЛЕНСКОЙ, КОВЕНСКОЙ, СУВАЛКСКОЙ, ГРОДНЕНСКОЙ И МИНСКОЙ ГУБЕРНИЙ
 СОСТАВИЛЪ КНЯЗЬ А.Э.ГЕДРОЙЦЪ.

Масштабъ 25 Верстъ къ Анк. Дюбле.

Материалы для Геологии Россіи Т.XVII.



КАТОРЪ 344 КАРТА С.С.

Q^4	Самыя послѣдствіенныя осадки (песчаные, галечные, иловые, глинистые, суглинистые, суглинистые).	R_3	Палеогенъ (лифвоніианская) — т.е. третичныя и четвертичныя долы (средне долы).		Предельное распространіе по архей-лифвоніанской осадкамъ.	J_2	Мѣра жеруля.	Δ	Населенныя фортификаціи.
Q^2	Возможныя послѣдствіенныя отложения (песчаные, галечные, иловые, глинистые, суглинистые, суглинистые) — т.е. послѣдствіенныя осадки (песчаные, галечные, иловые, глинистые, суглинистые).	S_2	Верхне-лифвоніанскія осадки (лифвоніанская) — т.е. третичныя и четвертичныя долы (верхне долы).	$?$	Возможныя осадки, по распространію неизвѣстныя.	$?$	Предельныя осадки: мѣра.		

Fig. 1 Original map of Antony Karol Giedroyc (1895), general view

al. 1969). He performed a great number of geological routes with observations, which extended from Minsk to Vilnius, Kaunas, Grodno and along the valleys of the main rivers (locations of these routes are depicted in figures by Dalinkevičius *et al.* (1969) and Paškevičius (2010)). He published his materials in 1895 (Giedroyc 1895), and the volume included a map (scale 1:420,000) (Baltrūnas, Pukelytė 2021) of outcropping rocks and sediments (Fig. 1). This map in eastern Lithuania (Fig. 2) displays the occurrences of laminated and non-laminated Quaternary (post Tertiary) sediments, Tertiary, Cretaceous and Jurassic outcrops, and the findings of phosphorites. The map is constructed on the basis of direct observations and descriptions of outcrops and exposures of Quaternary sediments and Pre-Quaternary rocks carried out by the author, also based on evidence by local people (e.g. observations of Cretaceous rocks).

The work (Giedroyc 1895) gives an explanation of the map. It is stated, “The scale is taken in order to depict accurately enough the exposures and outcrops of Pre-Quaternary rocks and formation, and it was not the aim to give the accurate cartography of Quaternary deposits” (in Russian, p. 323). The map displays local and areal exposures of rocks of Jurassic, Cretaceous and Tertiary ages; boundaries of the areas are given

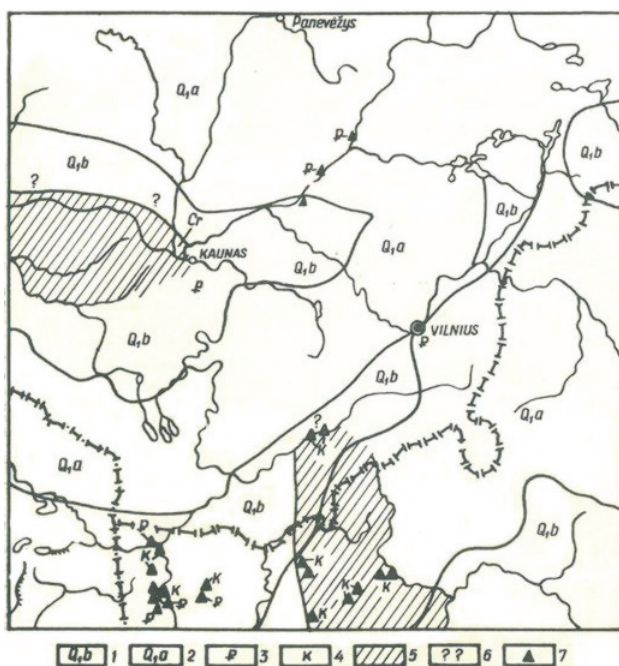


Fig. 2 Simplified part of the map of A.K. Giedroyc (1895), comprising Lithuanian part with adjacent areas only (modified by Dalinkevičius *et al.* 1969 and Grigelis *et al.* 1981). Legend: 1 – laminated Quaternary (post-Tertiary) sediments; 2 – not-laminated Quaternary (post-Tertiary) sediments; 3 – Tertiary (Paleogene) rocks; 4 – Upper Cretaceous rocks; 5 – inferred locations of Upper Cretaceous rocks; 6 – inferred locations of Jurassic rocks; 7 – findings of phosphorites

according to the actual observations of these rocks, except the northern boundary of Cretaceous deposits in the Kaunas governorship, where this boundary is drawn according to the type of Quaternary deposits located to the south, which contain a considerable part of Cretaceous material.

Giedroyc notes, “I did not dare to indicate continuous areas of distribution of Tertiary sediments due to the lack of data; however, the occurrence of such areas is possible in the territory between Grodno city and Šventoji River, which separates Kaunas and Vilnius governorships, as well as in Polesje, because of a considerable compound of Tertiary material in glacial deposits” (p. 324). Further, he notes that the presence of Devonian deposits in Polesje could be inferred according to the quantity and forms of red sandstones that occur in glacial deposits; however, there are no any actual data about the findings of Pre-Quaternary deposits, and this assumption is limited only to the data he observed personally. On the map, due to the lack of data on precise data, it was not possible to locate different types of post-Tertiary deposits, and only areas with prevailing non-laminated post-Tertiary sediments are separated from the areas with prevailing laminated sediments. Further, the problems of mapping of post-Tertiary sediments are to be discussed, and this will be a task for researchers in the future. It is noted in final remarks that western and southern parts of the area of his investigations described in the work of 1895 are not presented in the map under discussion due to a low density of locations of observations.

In general, it could be assumed that the map by Giedroyc is complex by its contents, as it displays occurrences of Quaternary and Pre-Quaternary sediments and rocks. However, it seems that the main aim of Giedroyc actually was to determine and map Pre-Quaternary geological formations although he also mapped laminated Quaternary (post-Tertiary) and non-laminated Quaternary (post-Tertiary) sediments. He was particularly interested in finding Tertiary, Cretaceous and Jurassic layers and outcrops, as he had a good knowledge of lithology and stratigraphy of these systems (Gedroitz 1880) and of data published by previous researchers. It has to be noted that Giedroyc’s map could have been used to map the European part of Russia (Baltrūnas, Pukelytė 2021).

There are no data whether Giedroyc was aware of or used former cartographic materials by Domeyko and other geologists of the 19th century, but it seems that geognostic contents of these maps were not useful nor acceptable for Giedroyc, as he used a modern stratigraphical approach and international standards. It should be noted that the Commission for the Geological Map of the World (CGMW) was already created in 1881 during the Second International Geo-

logical Congress (IGC) in Bologna, and it undertook the creation of international stratigraphical standards. It could be assumed that the members or representatives of the Geological Committee in St. Petersburg (founded in 1882) also took part in the Second IGC.

Upon comparison of the map of Giedroyc with the current Pre-Quaternary map of Lithuania (Fig. S1 in the Supporting Online Material; after Čyžienė, Šliaupa, 1999), which is based on materials of numbers of boreholes and geophysical and palaeontological investigations, it could be noted the following:

1. Giedroyc correctly determined Cretaceous layers in the south of Lithuania and in the vicinities of Grodno, as well as in the vicinities of Jurbarkas.
2. The Tertiary layers mapped by Giedroyc in the outcrops of the Šventoji River were later attributed to the Upper Devonian (Šventoji Formation), however there are also Neogene outcrops known so far (Anykščiai Formation).
3. The Tertiary layers in Vilnius vicinities mapped by Giedroyc could be Neogene or Pre-Pleistocene deposits according to the data from boreholes.
4. The Tertiary layers south of Kaunas could probably be related to blocks incorporated in glacial Quaternary deposits.
5. The Tertiary deposits in Suvalkija region (southern part of the map) recognised by Giedroyc are currently attributed to Paleogene.

We admit that the current knowledge is hardly comparable with that of the Giedroyc's time, but his discoveries, based on very few observations available at that time, actually are correct, and therefore the map of Giedroyc could be regarded as a prototype of modern geological maps.

CONCLUSIONS

1. The geological (geognostic) maps being the comprehensive reflection of the understanding of geological knowledge are dependent on the concepts of interpretation and explanation of geological data, especially on stratigraphy. The geognostic maps by Jean Etienne Guettard in 1764, Stanisław Staszic in 1806, Ignacy Domeyko in 1837, and Frederic Dubois de Montpereaux in 1830 reflect the history of geological science.

2. A new period of investigations and compilation of geological maps of the territory under consideration, using the stratigraphic concept starts about 1840.

3. The map of A.K. Giedroyc (1895) is a pioneering work of modern geological mapping using international stratigraphic standards.

4. The map of A.K. Giedroyc (1895) is complex and displays the occurrences of Quaternary and Pre-Quaternary (Tertiary, Cretaceous, and Jurassic) sediments and rocks. However, the main aim of Giedroyc actually was to map Pre-Quaternary geological formations. The map is constructed on the basis of direct observations and descriptions of outcrops and exposures of Quaternary sediments and Pre-Quaternary rocks carried out by the author, also based on evidence by local people.

5. The main occurrences (provinces) of Pre-Quaternary rocks mapped by Giedroyc are confirmed by the modern geological mapping of the 20th century.

ACKNOWLEDGEMENTS

Jaunutis Bitinas provided very useful insights dealing with modern geological maps. Reviewers Prof. Stanisław Wołkowicz and Prof. Valentinas Baltrūnas gave us very valuable comments and advices for significant improvement of the paper. The digital copy of the map by Antoni Karol Giedroyc (Гедройц, 1895) was kindly provided by dr. E. Rudnickaitė and this copy was received from professor Andrzej J. Wójcik (Polish Academy of Sciences).

REFERENCES

- Baltrūnas, V., Pukelytė, V. 2021. Geologas kunigaikštis Antanas Giedraitis – Vilniaus krašto gyventojas [Geologist Duke Antanas Giedraitis is a resident of Vilnius region]. *Voruta 4 (874)*, 47–54. [In Lithuanian].
- Breznynsky, K., Turczy, G. 1998. Geological Maps – from Lithography to GIS. *Földtani Közöny 128 (1)*, 145–156.
- Buch, von L., Rothenburg, F.R., Kliwer, H., Jätnig, C., Schmidt, P. 1826. *Geognostische Karte von Deutschland und den umliegenden Staaten in 42 Blättern nach den vorzüglichsten mitgetheilten Materialien*. Berlin: Simon Schropp & Comp.
- Chałubińska, A. 1961. Mapy ziem dawnej Polski Ignacego Domeyki (wiadomość tymczasowa). *Przegląd Geograficzny 33 (1–2)*. Warszawa: PWN.
- Chałubińska, A. 1962. Wkład Ignacego Domeyki do geologii Polski. *Studia i materiały z dziejów nauki polskiej*, seria C, z. 5. Warszawa: PWN.
- Čyžienė, J., Šliaupa, S. 1999. Revision of Pre-Quaternary geological map of Lithuania. Scale 1:200 000. *Lithuanian Geological Survey*.
- Dalinkevičius, J., Paškevičius, J., Vaitiekūnas, P. 1969. A. Giedraitis ir jo geologiniai tyrimai Lietuvoje [A. Giedraitis and his geological research in Lithuania]. *Geografinis metraštis X*, 223–232. [In Lithuanian].
- Dubois de Montpereux, F. 1830. Geognostische Bemerkung über Lithauen. *Arch. Mineral., Geogn. etc.* Bd. II, 135–156.
- Dufour, A., Wrotnowski, F. 1850. *Atlas de l'ancienne Pologne*. Paris.

- Eichwald, E. 1830. *Naturhistorische Skizze von Lithauen, Volhynien und Podolien in geognostisch – mineralogischer, botanischer und zoologischer Hinsicht*. Wilna, 256 pp.
- Fleszarowa, R. 1962. Najstarsza mapa geologiczna i najstarszy opis geologiczny Polski, *Studia i materiały z dziejów nauki polskiej*, seria C, z. 5. Warszawa: PWN.
- Gaigalas, A. 2002. Ignacy Domeyko's contribution to geological knowledge of Lithuania. *Polskie Towarzystwo Mineralogiczne – Prace specjalne Zeszyt 21*, 9–14.
- Gedroitz, A. 1880. Ueber Jura, Kreide und Tertiär in Russisch-Lithauen. *Schriftender Physikalisch – konomischen Gesellschaft*. Königsberg, in Commission bei W. Koch, 145–146.
- Giedroyc, A. 1895. Geologicheskiye issledovaniya v guberniyakh Vilenskoy, Grodenskoy Minskoy, Volynskoy i severnoy chasti tsarstva Pol'skogo [Geological studies in the provinces of Vilnius, Grodno, Minsk, Volhynia and the northern part of the Kingdom of Poland]. *Materials for geol. Russia 17*, 133–325. [In Russian].
- Graniczny, M., Satkūnas, J., Urban, H. 2002. Ignacy Domeyko indėlis į Lenkijos ir Lietuvos geologinį kartografavimą [Contribution of Ignacy Domeyko to Geological Mapping of Poland and Lithuania] *Ignotas Domeika 1802–1889: gyvenimas, darbai ir indėlis į mokslą: tarptautinės mokslinės konferencijos darbai [Ignacy Domeyko 1802–1889: His life, works and contribution to science: Proceedings of the International Scientific Conference]*. Vilnius, 186–190. [In Lithuanian].
- Graniczny, M., Kacprzak, J., Marks, L., Halina Urban, H. 2008. Józef Siemiradzki (1858–1933) – geolog niezwykły. *Przegląd Geologiczny 56* (5), 366–372.
- Grigelis, A., Kondratas A., Mikaila, V., Skuodienė, I. 1981. Pirmieji geologiniai tyrinėjimai [The first geological explorations] In: Grigelis, A. (comp.), *Lietuvos TSR geologijos istorija [The history of geology of the Lithuanian SSR]*. Vilnius, Mokslas, 23–51. [In Lithuanian].
- Helmersen, G.P. 1841. Poyasnitel'nyye primechaniya k general'noy karte gornyx formatsii Yevropeyskoy Rossii. [Explanatory notes to the general map of rock formations of European part of Russia]. *Gornyy zhurnal Part 2, Book 4*, 29–68. [In Russian].
- Murchison, R.I., de Verneuil, E., and von Keyserling, A. 1845. *The Geology of Russia in Europe and the Ural Mountains*. Vol. 1, Geology. London: John Murray. Vol. 2, Paléontologie. Paris: P. Bertrand.
- Paškevičius, J. 2010. Geologas Antanas Giedraitis ir jo vardo premija [Geologist Antanas Giedraitis and the Prize Named after Him]. *Geologijos akiračiai 1–2*, 80–82. [In Lithuanian].
- Satkūnas, J., Žalūdienė, G. 2007. Oldest geological maps of territory of Lithuania (the period until 1926). *Geologija 58*, 56–62.
- Satkūnas, J., Graniczny, M., and Urban, H. 2006. Oldest geological maps of Poland and Lithuania: facts and implications. *Abstracts of INHIGEO Conference*. Vilnius.
- Siemiradzki, J., Habdank-Dunikowski, E. 1891. Mapa geologiczna Królestwa Polskiego, Galicyi i krajów przyległych. *Pam. Fizyogr. 11*, 147 pp. Warszawa.
- Staszic, S. 1806. *Carta geologicatotius Poloniae, Moldaviae, Transilvaniae et partis Hungariae et Valachiae*. Inventa per Staszicanno 1806. Hoffmann delin. t. Frey sculp.t.
- Staszic, S. 1815. O Ziemiordztwie Karpatów, i innych gór i rownin Polski. W Warszawie, Roku 1815, w Drukarni Rządowej.
- Tarkowski, R. 2005. Nowe materiały dotyczące podróży przyrodnika francuskiego J.E. Guettarda do Polski (1760–1762). *Przegląd Geologiczny 53*, 1.
- Ulman, J. 1827. Geognosticheskoye opisaniye gubernii Vilenskoy, Grodenskoy i proch [Geognostic description of Vilnius, Grodno and other Governorates]. *Gornyy zhurnal 4*, 25–42. [In Russian].
- Vansovich, 1827. Geologicheskoye obozreniye Kurljandskoy i Lifyandskoy guberniy [Geological overview of Curonian and Livonian Provinces]. *Gornyy zhurnal 8*, 33–59. <http://elib.uraic.ru/handle/123456789/6406> [In Russian].
- Wolkowicz, S., Wolkowicz, K. 2014. Geological cartography in Poland in the 19th century. *Geological Quarterly 58* (3), 623–658. <http://dx.doi.org/10.7306/gq.1198>
- Wolkowicz, S., Wolkowicz, K. 2021. Ignacy Domeyko (1802–1889) – Carte Geologique de la Pologne – a story about the history of one map. *Book of abstracts 46th Inhigeo Symposium Poland*, 19–22 July, 59–60. https://www.inhigeo.com/publications/book_of_abstracts_2021.pdf
- Žalūdienė, G. 2006. Rytinio Baltijos regiono devono tyrimų istorija (iki 1940 m.) [History of Devonian research in the Eastern Baltic Region (before 1940)] *Geologija 53*, 57–67. [In Lithuanian].
- Žalūdienė, G. 2018. Antano Giedraičio geologiniai tyrinėjimai. Minint 170-ąsias gimimo metines [Geological explorations of Antanas Giedraitis. Celebrating the 170th anniversary of the birth]. *Geologijos akiračiai 1*, 17–20. [In Lithuanian].

Supporting Online Material
Figure S1