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THE USE OF LOWER-SILESIA SERPENTINITES IN THE EARLY MIDDLE AGES

Abstract: This paper concerns the results of the petrographic analysis of some serpentinite artefacts found at archaeological sites, dated back to the early Middle Ages. The well documented Lower Silesian serpentinite deposit exploitation during the Neolithic, incited the authors to verify whether these quarries were sourced in the early Middle Ages as well. The latter supposition was based on an existing collection of serpentinite items from the Ostrów Tumski archaeological site (Wrocław's Cathedral Island). As a result of their petrographic analysis the items were found to derive from the outcrops situated in the area of Jordanów Śląski (circa 40 km from Wrocław), the very region where Neolithic quarrying activities were previously recorded. Medieval usage of these rocks was much scarcer than in the Neolithic.

The highly evident import of serpentinite raw material to medieval Wrocław in the first quarter of the 11th century may be related to the process of the Cathedral's construction and decoration, as elements of the stone siding of its walls constitute the majority of the artefacts examined.

Keywords: Gogołów-Jordanów Massif, petroarchaeology, serpentinite, the early Middle Ages

In memoriam Alfred Majerowicz & Włodzimierz Wojciechowski

INTRODUCTION

Serpentinites have been used for carving, decoration, vases, and bowls for over three millennia. The oldest artefacts and quarries date back to ancient Egypt and Greece (Rapp 2009, 123).

In Pliny's *Natural History*, the name *serpentium* is mentioned in reference to serpentinite for the first time (Pliny 36.9.55). This rock was thus named for its markings, resembling those of snakes. Pliny also divided serpentinites into two types: the first – soft and light-colored, the second – hard and dark. They were some of the most desired rocks in the ancient Mediterranean world (Melfos 2008). As a quarried

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stone they seem to have been forgotten in Europe during the so called Dark Ages (c. 5th–10th century). Serpentinities are believed as a building and decorative stone in the 11th century (Kaźmierczyk 1990, 59–65). In 1546, they were described by Georgius Agricola in *De Natura Fossilium* (Agricola book IV, 80). The 17th and 18th centuries saw serpentinites quarried mainly in Northern Italy, Spain, and Poland for their use in the decoration of various residences of magnates, dukes, and kings (Sachanbiński 1979).

Pioneering petroarchaeological research carried out in the 19th century identified some European Neolithic artefacts made of soft, greenish rocks as jadeite, nephrite or serpentinite (Damour 1863; Fischer 1875).

The archaeological examination of Lower Silesian serpentinites first took place in the '40s of the 20th century. A broad study of Neolithic nephrite and serpentinite artefacts was presented by F. Geschwendt (Geschwendt 1941). In the '70s and '80s of the 20th century, W. Wojciechowski and A. Majerowicz commenced to examine the provenance of serpentinite axes and adzes while simultaneously conducting studies devoted to rock processing and deposit exploitation (Wojciechowski 1962; 1967; 1980; 1982; 1983; 1984; 1988; 2000). These long-term studies conducted by Polish and Czech scientists culminated in the release of a series of papers focused on the petrographic aspects of archaeological stone finds (Majerowicz et al. 1980; Prinke, Skoczylas 1980; Prinke et al. 1984; Kulczycka-Leciejewiczowa et al. 1996; Majerowicz et al. 1999; Majerowicz et al. 2000; Hovorka, Illášová 2002, 129–130; Cholewa 2004; Majerowicz, Siągło 2004; Prichystal 2009, 186–187). This research line, known as provenance studies, was conducted as early as the 1970s (Štelcl, Malina 1975, 110–111; Rapp 2009, 4; Hertz, Garrison 1998, 3). All the research mentioned above involved solely Neolithic artefacts while potential medieval and post-medieval quarrying activities had gone unnoticed until the release of Józef Kaźmierczyk's book describing the usage of stone in medieval Wrocław (Kaźmierczyk 1990).

Serpentinite artefacts from the early Middle Ages found in the region of Lower Silesia are the subject of this paper. Serpentinities are known mainly as material for the making of Neolithic axes and adzes. Recent analyses have shown that the same rock was extracted in the early Middle Ages from outcrops in the very same location as in the Neolithic.

AN OVERVIEW OF THE HISTORY OF SERPENTINITE EXPLOITATION IN THE EASTERN PART OF THE ŚLĘŻA MASSIF

Serpentinities occur in Poland only in Lower Silesia. The so-called Gogołów-Jordanów serpentinite Massif, part of the Mt. Ślęża ophiolite structure (see the petrographic characteristics below) is the largest recognized bedrock for these stones. From a geographic point of view serpentinite deposits encompass: the Kiełczyńskie Hills, the Radunia Group Hills, the Naślawickie Hills and the hill of Jańska Góra (Fig. 1 and 2).

The large-scale extraction of Lower-Silesian serpentinites from the region of Jordanów Śląski was initiated by the peoples of the Lengyel Culture (Cholewa 2004, 53;



Fig.1. View of Jańska Góra from the south (photo E. Lisowska)

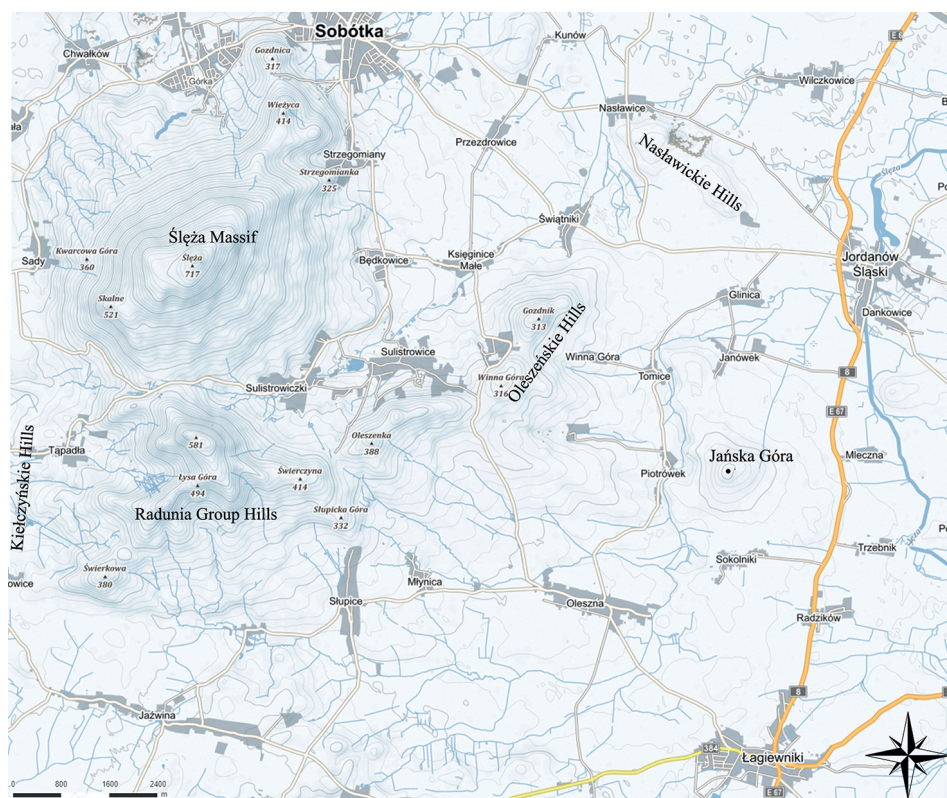


Fig.2. The region of Jańska Góra (draw. E. Lisowska, source: © OpenStreetMap contributors)

Kulczycka-Leciejewiczowa 1979, 150; Wojciechowski 2000, 89). The sourcing of this material was continued in later centuries by the Funnel Beaker Culture, the Globular Amphora Culture and the Corded Ware Culture. At the end of the Neolithic (Corded Ware C.) effective serpentinite axes, the so-called “Ślęza axes” were made (Wojciechowski 1988).

It seems that the Bronze Age brought about the weakening of interest in serpentinites among local societies. The petrographic studies of collections of stone artefacts of the Únětice Culture, published to date, do not confirm the usage of Sudetic serpentinite in their production (compare: Madej, Wójcik 2007). Later, in the Hallstatt period, just five artefacts made of serpentinite were identified among the Lusatian Culture collections in south-western Poland (Gediga 1967, 169; Gedl 1962, 81–82, 179, 377; Madej et al. 2003, 68; Romanow 1973, 159–164). A similar time-gap in the use of Lower-Silesian serpentinites is visible during the La Tène period and the Roman Iron Age. This status quo is primarily caused by the lack of comprehensive petrographic studies of the stone used in the epochs mentioned above.

During the early Middle Ages, by the end of the 10th century, the serpentinites from Jordanów Śląski were quarried again. Wrocław, with its stronghold situated on Ostrów Tumski (Cathedral Island) was the main, and it seems the sole, purchaser of these rocks. In the late Middle Ages (mid-13th to 15th century) there is little data to trace the intensity of the use of serpentinite. Just one pad made of this material was found in the 15th century layers in Węzienna Street in Wrocław (Wiśniewski 1999, 133–134), and the area of Jordanów Śląski was indicated as the possible source of the stone (Michniewicz 1999, 142). Further late medieval finds were recorded on the New Market in Wrocław, where, among 208 stone finds, just 3 were made of serpentinite from Jordanów Śląski (Gunia 2018, 1065; Lisowska 2018, 1049). During the Renaissance serpentinites from the Księginice Małe region were used in the architecture of the pulpit in the St. Mary Magdalene Church in Wrocław (Heflik 2010, 144; Sachanbiński 1979, 198). It is known, however, that a large increase in interest in the rock from the Jordanów Śląski area occurred in the 18th century, when multiple architectural details such as altar slabs and columns, as well as haberdashery were made of our Sudetic serpentinite (Gunia 2012, 244–247; Lisowska 2012, 231; Sachanbiński 1979, 198). In the 18th and 19th centuries serpentinite extracted from the bedrock of the Gogołów-Jordanów Massif was at times used to erect walls and other small, local architecture in the vicinity of the rock deposits (for example serpentinites were used in the neo-Gothic palace in Piotrówek or for the construction of the Bismarck Tower, raised in 1869, which still stands at the top of the hill of Jańska Góra. Nowadays antigorite serpentinite is extracted commercially in Nasławice (approximately 2 km from Jordanów Śląski) – the only site in Poland currently quarried for serpentinite in the eastern part of the Ślęza Massif, where hundreds of small abandoned quarries from different stages of the evolution of prehistoric, medieval and modern societies can be found (Fig. 3). Some of these quarries have been investigated through excavation in order to verify their chronology (Wojciechowski 1984).

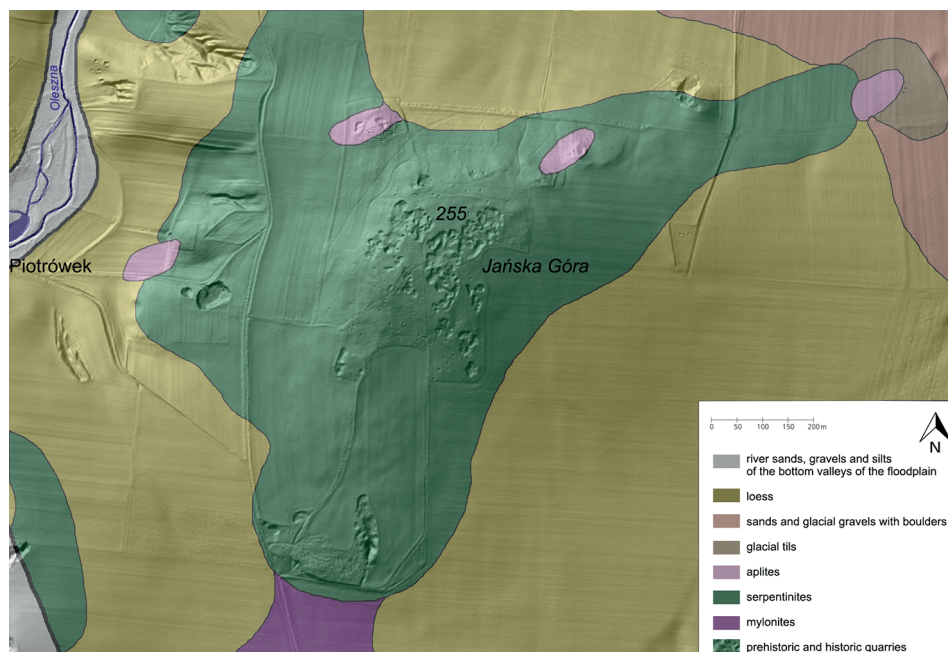


Fig.3. The digital elevation model and geological map compilation of the Jańska Góra serpentinite quarries (sketch by E. Lisowska, on the basis of Geological Map 1:25 000 and data from the Geodesic and Cartographic Documentation Center)

THE PETROGRAPHIC CHARACTERISTICS OF SERPENTINITES

The Gogołów-Jordanów serpentinite Massif, situated approximately 50 km south of Wrocław, belongs to the lowest part of the ancient (Lower Paleozoic) oceanic crust (ophiolite suite; sensu: Pin et al. 1988, 206). The approximately 15 km long and 5 km wide, W-E elongated belt consists of strongly serpentinized primary harzburgites with minor amounts of pyroxene-amphibole-bearing rocks (Fig. 4). Recently, these ultrabasic rocks have been observed to occur in the small abandoned quarries and pits localized along the eastern edge of the aforementioned massif between Jordanów Śl. (in the north) and Radzików (in the south). From a petrographic perspective, they can be classified as antigorite serpentinites with well-developed interpenetrating or interlocking structures composed mainly of needle-shaped or spherulitic assemblages of serpentine, which had replaced the primary silicates entirely. However, the internal structures of serpentine visible in the background of the Gogołów-Jordanów rocks differ entirely from those observed in the serpentinites occurring in their vicinity. These adjacent serpentinites form small lenses within the gneisses of the Foresudetic part of the Sowia Góry Block at the NE edge of the Bohemian Massif (Gunia 1997, 79; Borowski 2007).

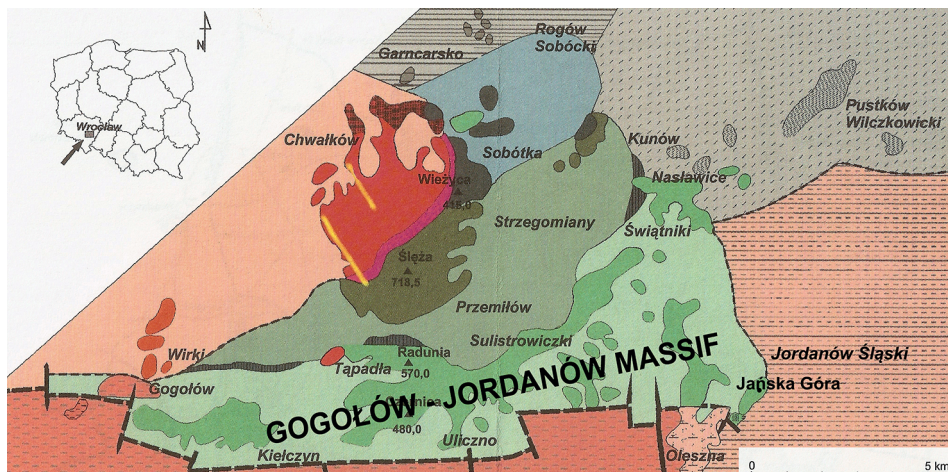


Fig.4. A geological sketch of the Śląska Group with the green coloured Gogołów-Jordanów serpentinite Massif (after Majerowicz 2006)

It's worth mentioning that the entire collection of about 800 rock items from the early Middle Ages found at the Ostrów Tumski archaeological site (Wrocław's Cathedral Island) includes just a few serpentinite artefacts. A detailed description of the typological features and cultural significance of these tools is presented below. The salient results of microscopic studies of thin sections of serpentinites, using the transmitted light technique, are summarized the part of the paper that follows.

In terms of petrography, two varieties of serpentinite the objects were made of can be distinguished: antigorite serpentinite with relics of primary silicates (olivine, clinopyroxene) and antigorite serpentinite with carbonate veins and patches.

Antigorite serpentinites with relics of olivine (or pyroxenes) are dark-green in colour with frequent small black patches and spots on their outer surfaces. The results of microscopic examinations of thin sections indicate that flame-shaped intergrowths of antigorite platelets are most common in the background. Locally, they consist of cloudy impregnations of small magnetite microspherules. Sporadically, against a background of needle-shaped antigorite, sharp-edged (dismembered) fragments of olivine (forsterite) can be observed. In some areas, crushed fragments of clinopyroxene prisms showing well-defined (100°) cleavage occur. Occasionally, the larger bastite pseudomorphs after pyroxene filled with thin needles of secondary serpentine are present. Many areas comprise bigger, amoeboidally shaped chromian spinel grains (picotite) up to several millimetres in size. Other parts show serpentine assemblages transected by striations filled with fine magnetite microspherules or secondary (rhomboedric-shaped or microcrystalline) carbonates.

Antigorite serpentinites with carbonates are the most widespread variety of the serpentinites examined. Observation with the naked eye reveals the dark greyish-green colour with characteristic small rusty patches and veins on fresh surfaces

and an aphanitic structure. Under magnification, in the background, needle- and flame-shaped tightly-interwoven antigorite platelets are frequent. These are often accompanied by cloudy assemblages containing unoriented sets of magnetite microspherules. Only in one of the thin sections from this group, bastite pseudomorphs after primary pyroxenes have been found. Many areas show multiple striations filled with microcrystalline carbonate (magnesite) against a background of serpentine. Locally, carbonates form isolated, irregular patches or spots (up to 2 mm in diameter) against a fine-grained serpentine background.

Considering the above, we can say that the early medieval serpentinites examined show structures and a mineral composition typical of serpentinites from the eastern part of the Gogołów-Jordanów Massif (Jordanów, Jańska Góra). The results of petrographic analyses indicate that the serpentinite was imported in the early Middle Ages from outcrops localized far of 40–50 km from Wrocław.

SERPENTINITE ARTEFACTS FROM THE EARLY MIDDLE AGES IN LOWER SILESIA

Stone artefacts made of serpentinite were discovered at only 3 archaeological sites from the early Middle Ages in Lower Silesia. The greatest concentration of these rocks was recorded in the stronghold situated on Wrocław's Cathedral Island (22 pieces, about 5 percent of the whole group of stone objects – Table 1). Five serpentinite items were uncovered in the years 1941, 1963 and 2011 in the New Market in Wrocław, and one small fragment of a whetstone derives from the 9th–11th century settlement in Żukowice, site No 47 (compare: Lisowska 2013, catalog No. 12og, 12oh, 129j; Lisowska 2018; Gunia 2018).

In view of the large number of serpentinite artefacts discovered in layers from the end of the 10th to the mid-13th century in the stronghold on Wrocław's Cathedral Island a decision was made to carry out a detailed microscopic analysis of the serpentinites in question to identify their petrographic features. Based on the laboratory analyses the authors managed to determine the provenance of the examined material (see the petrographic characteristics above).

Among the serpentinite items in question (found during archaeological excavations on Wrocław's Cathedral Island), slabs which were polished on one or both sides dominated. Generally these slabs were used as cladding or flooring material. The smoothing of the outer surface brought out the green snake-skin nature of these decorative rocks. Individual serpentinite items should be regarded as polishing stones, that could have in turn been created from broken or damaged lining slabs. In the early medieval layers excavated on Cathedral Island, 17 cladding slabs and 7 polishing stones were uncovered. The shape of some small serpentinite pieces suggests whetstones, but the rather weak frictional properties of these rocks definitely preclude their use as such.

Table 1. Wrocław - Ostrów Tumski. Specification of serpentinite artefacts.

Ordinal number	Inv. Numer	Trench No, layer	Function or secondary function	Chronology	Measurements (cm)
1.	46/56	VI/56, II/III	Touchstone	Mid–13 th century	7,57×3,26×3,16
2.	52/56	VI/56, II/III	Polishing stone	Mid–13 th century	8,02×3,11×2,4
3.	206/60	VIII/60, II/III	Polishing stone	End of the 11 th century	3,73×3,81×2,3
4.	37o/76	I/76, J	Decorative stone	Mid–11 th century	9,9×11×1,3–3,2
5.	53h/77	I/77, O	Polishing stone	1 st quarter of the 11 th century	11,2×4,3×2,6
6.	148d/77	I/77, P	Decorative stone	1 st quarter of the 11 th century	25,2×13,0×5,4–5,6
7.	158p/77	I/77, P1	Decorative stone	1 st quarter of the 11 th century	10,2×5,5×2,2
8.	173a/77	I/77, R	Decorative stone	10 th /11 th century	12,2×8,2×2,5–3
9.	190j/77	I/77, R	Polishing stone	10 th /11 th century	1,4×3,6×2,2
10.	87f/78	II/78, O	Decorative stone	1 st quarter of the 11 th century	12,7×12,7×1,8–4,5
11.	111l/78	II/78, S	Decorative stone	2 nd half of the 10 th century	12×9×3,5
12.	120l/78	II/78, S	Decorative stone	2 nd half of the 10 th century	15,4×12×5,4
13.	181a/78	II/78, P	Decorative stone	1 st quarter of the 11 th century	8×6,5×3,2
14.	182a/78	II/78, P	Decorative stone	1 st quarter of the 11 th century	18×7,3×2–2,5
15.	182e/78	II/78, P	Decorative stone	1 st quarter of the 11 th century	12×10×2
16.	5/79	II/79, B–F	Decorative stone	11 th /12 th –2 nd half of the 13 th century	8,2×7,1×1,7
17.	7k/84	III/84, B6	Polishing stone	1 st quarter of the 12 th century	5×1,8×1
18.	136c/85	III/85, C3	Polishing stone	3 rd quarter of the 11 th century	11,2×10,2×1,2–1,8
19.	62l/86	III/86, F1	Decorative stone	10 th /11 th century	14,5×13,5×3,2
20.	76c/88	IIIA2/88, D2	Polishing stone	2 nd quarter of the 11 th century	5,2×2,4×0,7–1,2
21.	123c/88	IIIA2/88, E1	Polishing stone	1 st quarter of the 11 th century	5,5×3,5×1
22.	18a/89	III/A3/89, C3	Decorative stone	2 nd quarter of the 11 th century	12×4,5×3,5

The serpentinite artefacts were found in several trenches (Fig. 5) in early medieval layers located on Wrocław's Cathedral Island (Kaźmierczyk 1990, 51–55). Most of them (7 pieces) were recorded in layers dated to the end of the 10th century and the 1st quarter of the 11th century in trench number II/1978. Not much fewer of the serpentinite items (6 pieces) were found in similarly dated layers in trench number I/1972–1977. 6 serpentinite artefacts were documented in trench number III/A/1983–1989 (III, IIIA2, IIIA3) in various layers dated from the end of the 10th century to the 12th century. Two items were discovered in 12th–13th century layers in trench number VI/1956, and only one fragment was observed in trench number VII/1960.

Józef Kaźmierczyk was first to record, publish and draw attention to serpentinite slabs (1990, 20). He mentioned that these artefacts may have come from the first stone church that was destroyed during the pagan reaction in 1038. He argued that the large accumulation of the slabs in the direct neighborhood of the church is evidence strongly in favor of his hypothesis. The serpentinite pieces were reused after the 1st quarter of the 11th century as hearth lining, whetstones, and polishing stones, as

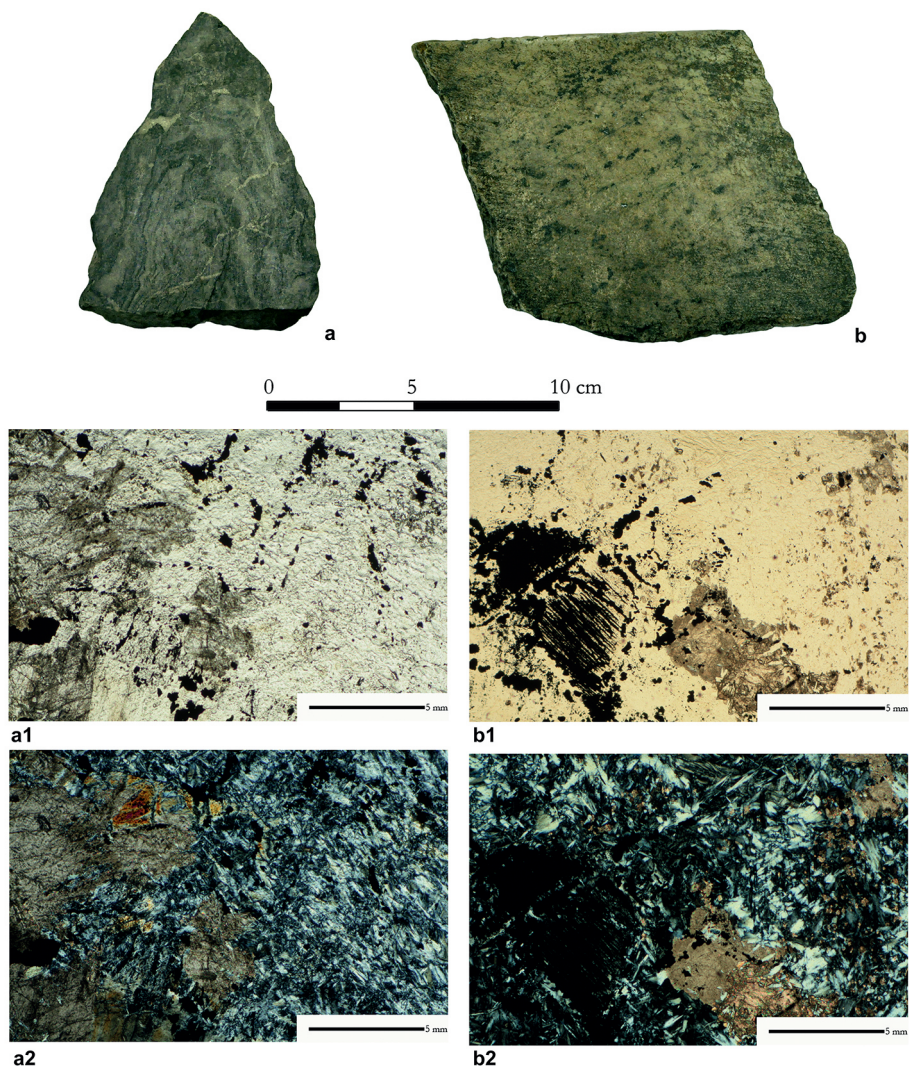


Fig.5. Serpentinite lining slabs from the Ostrów Tumski archaeological site (Wrocław's Cathedral Island) and their petrographic features. a – lining slab No inv. 52a/76, a1 – microphotograph of the thin section made from the slab, parallel nicols, a2 – microphotograph of the thin section made from the slab, crossed nicols (cat. No 62), b – lining slab No inv. 136c/85, b1 – microphotograph of the thin section made from the slab, parallel nicols, b2 – microphotograph of the thin section made from the slab, crossed nicols (cat. No 25). (photo P. Gunia, E. Lisowska)

well as other articles of daily use. They were found inside houses, in the streets and in storage and utility rooms in the immediate vicinity of the Cathedral.

A graph showing the growth dynamics of serpentinite import (Fig. 6) makes it clear that in the 1st quarter of the 11th century the inflow of the raw material was the

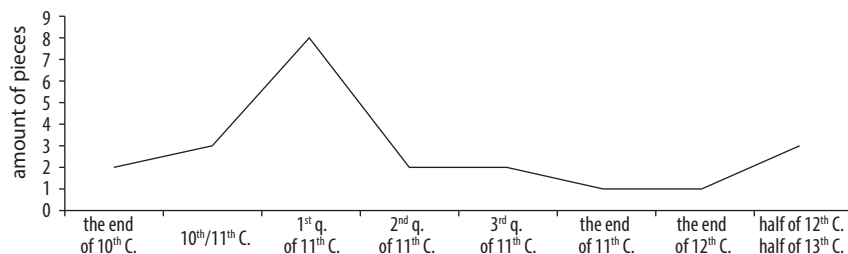


Fig.6. A graph presenting the dynamics of serpentinite inflow to Wrocław's Cathedral Island in during the early Middle Ages (sketch by E. Lisowska).

most intensive. There could be two reasons for the prominent growth in demand for serpentinite. Firstly – the increase in the number of different objects generally observed during this time in Wrocław, which can be associated with the development of the center and the rise of local crafts and trade. Secondly – in relating to the spatial analysis of the density of serpentinite item distribution on Cathedral Island. Most of the serpentinite slabs have been recorded in trenches I and II (1972–1979), which were located close to the Cathedral (Kaźmierczyk 1990, *passim*). The increase in the number of serpentinite pieces in the 11th century used primarily for the manufacture of lining, may be directly related to the construction of the Wrocław Cathedral, particularly to its finishing work and interior decoration. What is strongly in favor of this option is the fact that the mass import of serpentinite took place only in the center of Wrocław and has not been observed at other early medieval sites in Lower Silesia.

DISCUSSION

In the early Middle Ages, starting with the end of the 10th century, the sourcing of serpentinites from the area of Jordanów Śląski was barely visible, and taken notice of, in the archaeology of rock quarrying, on a much smaller scale than that taking place in the Neolithic. This observation is reflected in the overall ratio of the number of serpentinite finds since the Neolithic, which significantly outnumber medieval ones. Moreover, Neolithic serpentinite finds (Cholewa 2004, *passim*) are much more widespread than those from the Middle Ages. The lower intensity of serpentinite exploitation during the Middle Ages as compared to the Neolithic is also confirmed by the fact that there are no known jade products from medieval sites in Central Europe. This rock often accompanies serpentinites within the territory of the Gogołów-Jordanów Massif (for example in Nasławice). Apart from its attractiveness, jade was probably extracted in the Neolithic as a result of the intensive quarrying activity in the Jordanów region and a very good recognition of the outcrops in this area. This manner of proper and detailed “petrographic field query” of the Jordanów region was unknown or unnecessary to medieval societies, whereas various other rock types were exploited in multiple parts of the Sudety Mountains.

Sourcing serpentinite in Lower Silesia during the early Middle Ages was based, *inter alia*, on the deposits located in the area of Jordanów Śląski, which the analysis of some stone artefacts has confirmed. A very high percentage of serpentinite items found on Cathedral Island, in comparison to their lack at other early medieval archaeological sites, indicates that the import of this raw material from the area of Jordanów Śląski to Wrocław was deliberate. The intensive increase in interest in serpentinite in the 11th century observed in Wrocław may be associated with the development of stone architecture (especially lining work) and the stonework related to the construction of the Wrocław Cathedral.

The geology of Europe includes several regions where surface deposits of serpentinite render the stone easy to quarry (Coleman 1977). In medieval Europe, there were only several serpentinite outcrops decorative material to be used in architecture was acquired from. In the Middle Ages well-known deposits were situated mainly in Northern Italy in the region of Valmalenco valley (Cavallo, Rimoldi 2013), the Cogne mining district (Toffolo 2017), Valtellina and Valchiavenna (Cavallo 2015) and at several locations in Spain (Pereira et al. 2010, Nespereira et al. 2019). Other serpentinite deposits in Europe were quarried rarely, at times as a side effect of the simultaneous extraction of the more popular and desirable soapstone, as observed in Norway (Storemyr, Heldal 2002). In some cases, serpentinite was wrongly referred to as marble (Navarro et al. 2013), perhaps because marble was the most popular decorative stone in medieval architecture (Cassar et al. [eds.] 2014). The usage of serpentinites in order embellish medieval architectural elements is rather infrequent in Europe, mainly because of the scarcity of their deposits and quarries. Serpentinite as a building stone was used in sacral architecture, *inter alia* in Rome, the Vatican, Venice and Florence (Malesani et al. 2003; Marino et al. 2004), Westminster Abbey (Sharp 1999) and the Hagia Sofia in Istanbul (Melfos 2008, 395).

The importance of the monuments mentioned, as well as the scarcity of occurrence of serpentinites in Europe during the Middle Ages, show that the application of this green stone in the 11th century Wrocław Cathedral, might be a unique but non-local phenomenon, highlighting Wrocław's possible role as one of the leading geopolitical centres in the state of the first Piasts. However, the usage of serpentinite could have a more prosaic explanation – that being Wrocław's proximity to its outcrops and the ease of its extraction from the bedrock. The region of Jańska Góra and Jordanów Śląski was densely settled in the 10th and 11th centuries, and part of the population conducted quarrying activities in the Ślęża Massif and within the surrounding hills. In this situation the extraction of serpentinite and other rock was something natural as a result of surface exploitation of the geological structure of the Ślęża ophiolite.

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