

5. Possible sources of raw materials used for prehistoric stone implements in the Sykourio and Elateia basins, Eastern Thessaly, Greece

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5.1. Introduction

Prehistoric people around the Aegean had an excellent knowledge of the physico-mechanical properties of minerals and rocks, and used them for producing their tools. The early farmers selected the available high quality raw materials for specific purposes and uses from local resources by direct exploitation, or procured them from distant sources via exchange networks.¹ But even before, during the Mesolithic, specific materials were exchanged, e.g. andesite or obsidian.² Exploitation of the local natural resources in dynamic landscapes was a common practice, when the sources were accessible.

Prehistoric people collected the raw materials either by quarrying the rock outcrops or by selecting gravel and pebbles from plain, river and stream sediments.³ This was very common in prehistory because raw materials in sediments are characterized by very good properties, were easily accessible, and could be processed with less effort than the quarried blocks.⁴

The basins of Sykourio and Elateia and the surrounding mountains and hills are characterized by a dynamic “lithic” landscape with diverse geological contexts. Moreover, they are located at the edge of the plain of Thessaly, which comprises a very dense network of Neolithic sites, implying possible communication and interaction practices. The present contribution discusses the potential sources of the raw materials that were used for the production of Neolithic stone implements, collected during the surface survey in the Sykourio and Elateia basins.

The total number of the prehistoric stone implements amounts to 1264 pieces, which were macroscopically classified in various rock or mineral types (Table 5.1) by Vasilios Melfos and Agathe Reingruber. The characterization of the raw materials was based on their macroscopic geological features, but no mineralogical, petrographic or geochemical study was applied at this stage of the research. This is planned for the next step of the investigation and as a consequence, the final classification may be slightly changed.

The present study provides conclusions about the specific rock types used by the Neolithic inhabitants of the basins and the possible locations for the raw materials procurement.

5.2. Geological setting

The rock formations around the Sykourio and Elateia basins belong to the Pelagonian zone (Figure 5.1). This geotectonic zone consists of several units that demonstrate different metamorphic transformations (Figure 5.2). In the broader area of Eastern Thessaly, the pre-Alpine crystalline basement is represented by mica schists with marble intercalations, gneisses and granitoids of Paleozoic ages. This unit is structurally overlain by the composite Eohellenic or Pelagonian nappe consisting of a basal tectonic *mélange*, including Triassic metamorphosed mafic ophiolitic and Triassic-Jurassic deep-water metasedimentary rocks. These rocks are represented in the area of Sykourio and Elateia by amphibolites, prasinites and schists, with intercalations of marbles.⁵

These series were overthrust by ophiolite complexes of ultramafic and mafic rocks found mainly in Eastern Thessaly. The ophiolites consist of a locally developed metamorphic sole of

¹ Perlès 1992, 1994; Perlès et al. 2011; Stergiou et al. 2022; Stratouli 2005; Stroulia 2010, 2018, 2020; Melfos and Stratouli 2016; Reingruber 2018; Melfos et al. 2020.

² Runnels 1981, 100; Reingruber 2018, Fig. 2.

³ Melfos and Stratouli 2016; Bekiaris et al. 2017; Melfos et al. 2020; Elefanti et al. 2020; Stergiou et al. 2022.

⁴ Melfos et al. 2020.

⁵ Kiliyas and Mountrakis 1989; Anders et al. 2007; Koutsovitis 2017.

Type of rock or mineral	Number of artefacts	Percentage
Metamorphic rocks		
Gneiss	104	8.2
Schist	15	1.2
Amphibolite	1	0.1
Marble	62	4.9
Serpentine	50	4
Sub-total:	232	18.4
Sedimentary rocks		
Sandstone	23	1.8
Sub-total:	23	1.8
Igneous rocks		
Gabbro	46	3.6
Granite	2	0.2
Basalt	1	0.1
Andesite	1	0.1
Obsidian	465	36.8
Sub-total:	515	40.8
Minerals		
Chert/Radiolarite	306	24.2
Quartz	188	14.8
Sub-total:	494	39.0
Total	1264	100

Table 5.1. Characterization and classification of the raw materials used for the production of lithic implements in the Sykourio and Elateia basins (data were kindly provided by Agathe Reingruber).

amphibolite to greenschist metamorphic grade, as well as serpentinites, and an extended ophiolite breccia which lies at the top of the main bulk of the ophiolitic sequence, in the Chassambali Hill⁶, demonstrating a Late Cretaceous age. The ophiolite is overlain by crystalline limestones of Late Cretaceous age.⁷ This unit is, in turn, unconformably overlain by unmetamorphosed Pleistocene to Holocene sediments consisting of old talus, torrential terrace material and alluvial deposits (Figure 5.2).

The Pelagonian continental basement (Figure 5.1) demonstrates a pre-Alpine, probably Hercynian, deformation, whereas the rocks of the Pelagonian nappe were variably metamorphosed.⁸ They were subjected to three main regional metamorphic events: a) greenschist (Middle Jurassic-Early

Cretaceous), b) blueschist (post-Cretaceous to pre-Late Eocene) and c) low-grade metamorphism (Middle Eocene). The latest two metamorphic events are related to the Cretaceous-Early Tertiary continental collision. The intensive tectonism was followed by shear deformation, which brought about multiple zones of mylonitization and imbrication, and thrusting of the units from east to west.⁹

5.3. Raw materials of the lithic implements and potential sources

The characterization and classification of the raw materials used for the 1264 implements are shown in Table 5.1. The raw materials are determined

⁶ Melfos 2008.

⁷ Katsikatos et al. 1981; Kiliass and Mountrakis 1989.

⁸ Kiliass and Mountrakis 1989.

⁹ Koukouvelas 1994.

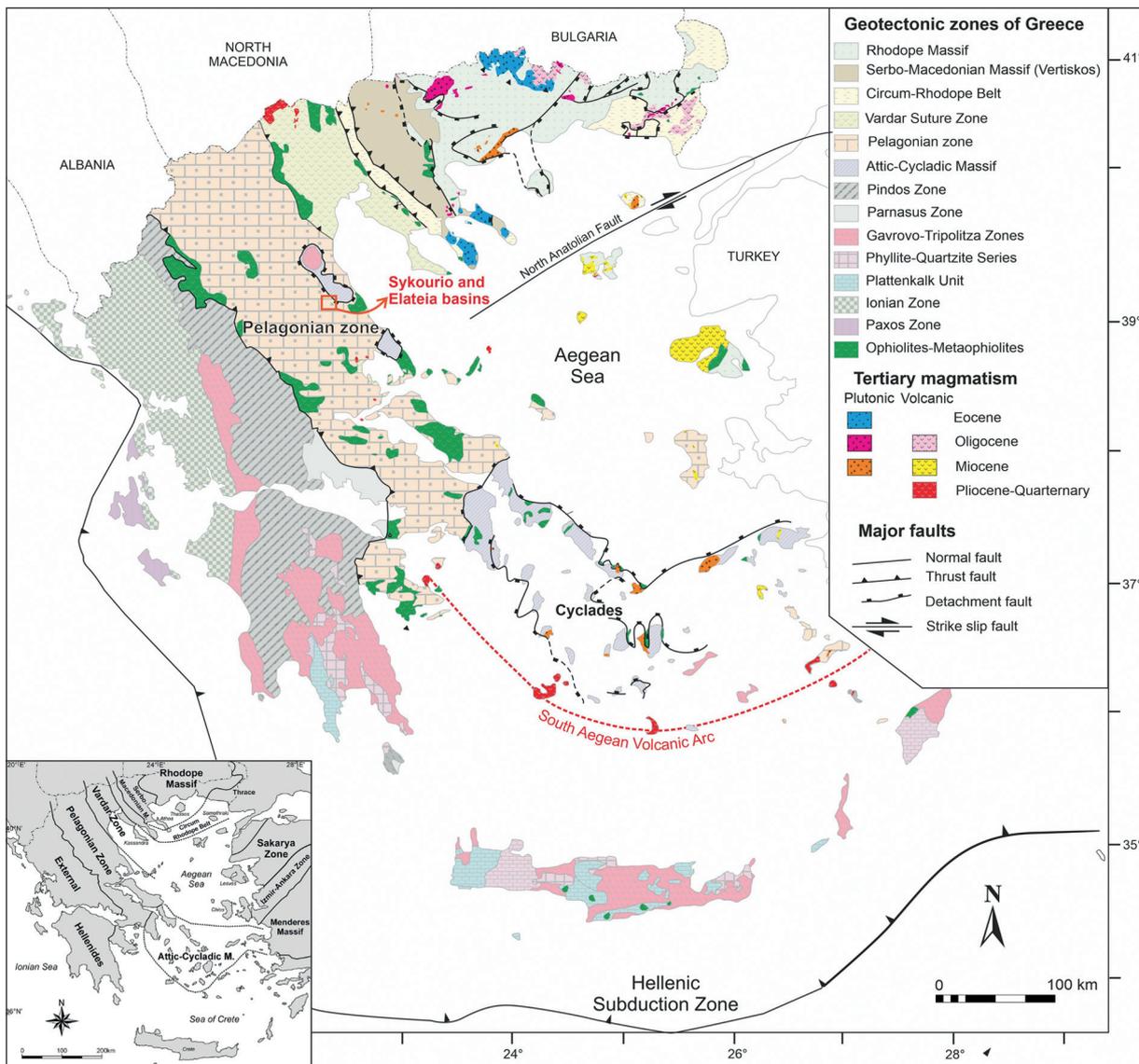


Fig. 5.1. Geological map of Greece demonstrating the geotectonic zones, the major faults and the main magmatic rocks. The Pelagonian zone and the Sykourio and Elateia basins are also shown (modified after Mountrakis 2010 and Melfos and Voudouris 2017).

as metamorphic (231 implements, 18.4%), sedimentary (23 implements, 1.8%) and igneous rocks (515 implements, 40.8%). The rest consists of minerals, amounting to 494 implements (39%). The main metamorphic rocks that were used as raw materials for the implements are gneiss (104 pieces), marble (62 pieces), serpentinite (50 pieces), schist (15 pieces) and amphibolite (1 piece). These rocks are the main lithotypes of the mountains and hills around the two basins (Figures 5.2 and 5.3a–d). However, despite this frequency, it seems that the Neolithic people did not quarry them, but instead they collected large gravel and

pebbles of these rocks from the Pleistocene and Holocene sediments or from riverbeds (Figure 5.3e). Because of the rocks' good quality, they could be easily processed.

Large quartz veins or sills are hosted in the metamorphic rocks, especially in the gneisses, the schists and the amphibolites (Figures 5.2 and 5.3d,f). These outcrops are characterized by white coarse-grained quartz and their length exceeds 200 m. Due to the hardness of quartz, numerous pebbles are found in the sedimentary deposits of the Sykourio and Elateia basins. Additionally, large slabs of quartz, >3 m long, coexisting with

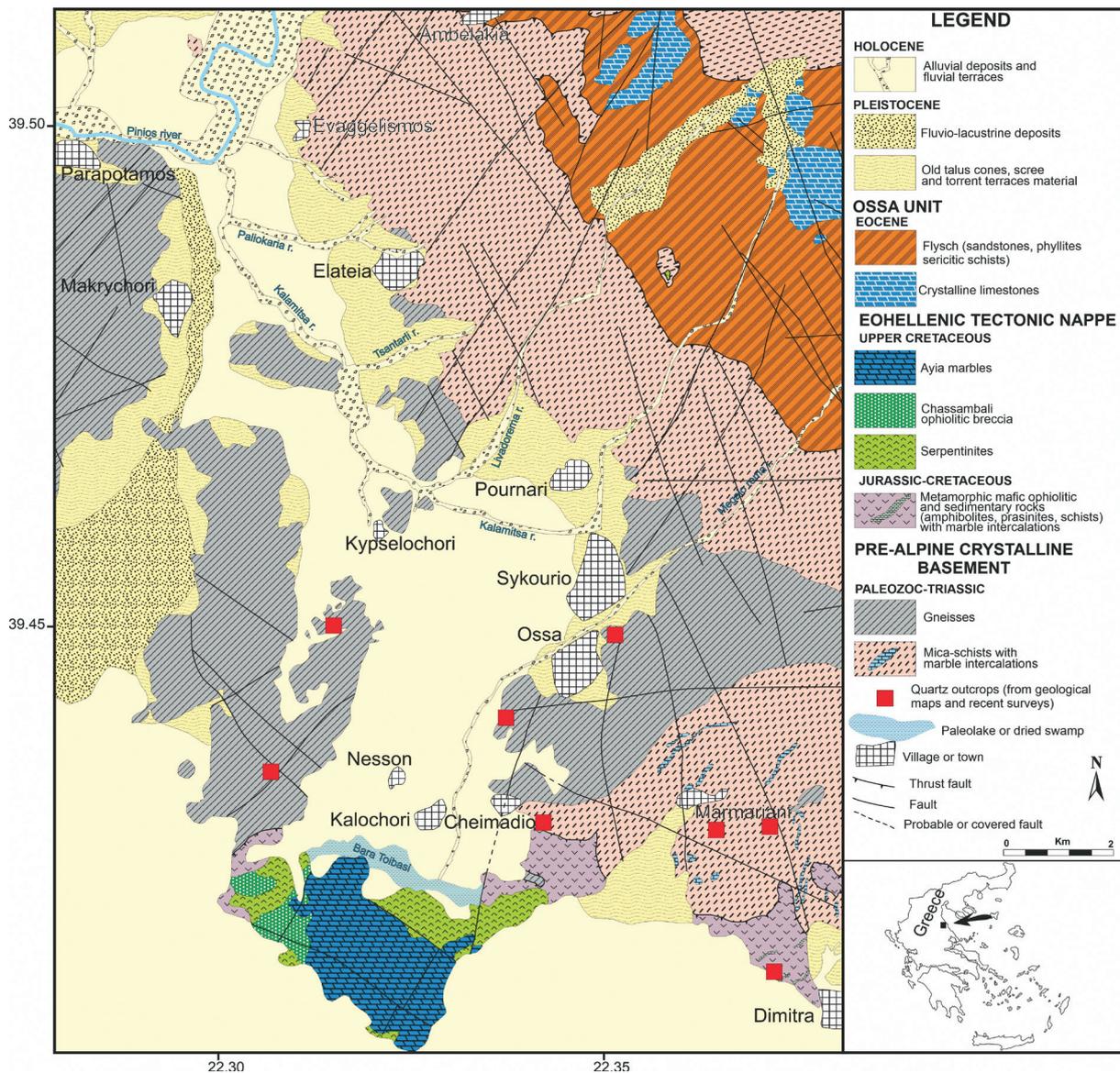


Fig. 5.2. Geological map of the Sykourio and Elateia basins' broader area (compiled by Katsikatsos et al. 1981; Plastiras 1985; Katsikatsos and Migiros 1987; Migiros 1987). The main quartz outcrops are also shown.

numerous small pieces, are widespread around the basins, on the slopes of the mountains and the hills. It is obvious that quartz was everywhere and could be easily obtained by prehistoric people from all these occurrences. The total of 188 implements (~15%) verifies this assumption. A common feature of quartz in these outcrops is the goethite inclusions. These inclusions are small in size and probably were formed from the oxidation of primary iron rich minerals, e.g. pyrite, pyrrhotite or magnetite. Usually, this oxidation gives a brownish tint to the white color of quartz. Generally, this kind of inclusions is typical for quartz veins.

The sedimentary rocks are represented in the collection of implements by a restricted number of sandstones (23 pieces) implying also a local source, because they are abundant in local sedimentary deposits.

In contrast to these local resources, there are several raw materials, including igneous rocks and cherts/radiolarites, which were imported from short, long or very long distances. The largest group is a "treasure" of 465 pieces of obsidian (compare contribution by P. Nedelcheva, this volume), which probably derives from the Aegean island of Melos. This group accounts for almost 37% of the total

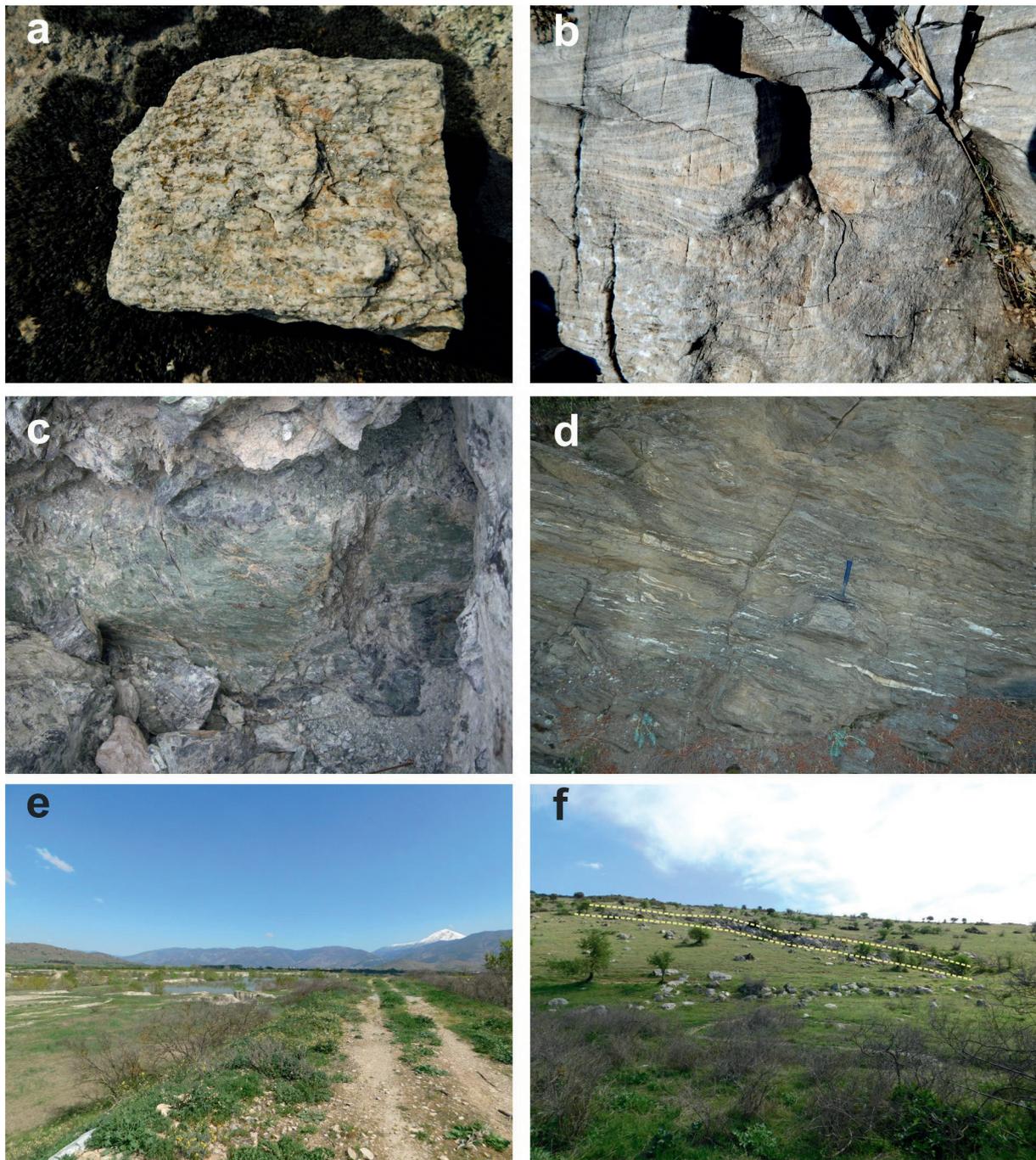


Fig. 5.3. Outcrops of different rock types near Sykourio: a. Gneiss west of Kypselochori; b. Marble in schists close to Marmariani; c. Serpentinite from the Chassambali Hill; d. Schists with quartz sills that are developed along the schistosity; e. The Pleistocene and Holocene sediments contain numerous gravel and pebbles of good quality gneiss, marble, serpentinite, schist and quartz. The snowy peak of the Ossa mountain is shown in the background; f. A large quartz vein crosscutting the gneiss and large slabs on the slope of the hill, north of Cheimadio.

collection, and is surprisingly very high. Obsidian is a very rare type of rock and consists of almost pure volcanic glass; it was used for the production of high-quality chipped stone tools during

prehistory. Melos, an island of the Cyclades, is far away from Sykourio and Elateia, and the obsidian implements were probably transported through various complex exchange networks. The

second largest group of non-local raw materials is gabbro. This rock type is common in Thessaly (e.g. in the area of Volos) and is mainly associated with ophiolitic rocks. However, it is not found in the vicinity of the area under research, and so it is suggested that the implements were transported as final products to the Neolithic sites of Sykourio and Elateia basins, rather than as unprocessed raw materials.

This is also the case for the two implements made of granite and one made of basalt. These rocks are also widespread in the broader area of Thessaly, but there are not any outcrops around the area under study. One implement was made of andesite, a volcanic rock found in the Rhodopes of Thrace, in Almopia of Northern Greece, in the Argolid of the Peloponnese and in the Cyclades. Further mineralogical and geochemical research is required for the determination of the precise origin of andesite. However, we may assume Melos island as a probable source. Andesite could have been transported to Thessaly via the same exchange networks with the Melian obsidian.

Chert/radiolarite is geologically associated to either ophiolite series or limestone sequences¹⁰ and is primarily used for the manufacture of chipped stone tools. The nearest chert/radiolarite resources are found in ophiolites of the Koziakas mountain, Western Thessaly, and in limestones of Western Greece. Therefore, these raw materials were not obtained from the vicinity of the Sykourio and Elateia basins, but were transported from distant areas.

5.4. Conclusions

The 1264 stone implements collected during the intensive surface surveys in the basins of Sykourio and Elateia were made of local, non-local and “exotic” raw materials. A total of 442 implements are from adjacent sources, including gneiss, marble, serpentinite, schist, amphibolite, quartz and sandstone. The prehistoric people probably collected these raw materials from sedimentary deposits and riverbeds, which contain good quality gravel and pebbles of these rocks, rather than quarrying them from primary outcrops.

The rest of the 822 implements were made of raw materials that are not from the vicinity of the area, but instead are found at long or very long distances. The two largest implement groups were made of obsidian (465 pieces) and chert/radiolarite (306 pieces), which are the most common raw materials for the production of chipped stone tools. It is noteworthy that for this category of tools, the raw materials were totally absent in the Sykourio and Elateia basins. Obsidian probably came from Melos island in the Cyclades, whereas cherts/radiolarites were from Koziakas or even from greater distances in Western Greece.

A group of implements made of gabbro (46 pieces) and a few made of granite and basalt were transported from shorter distances within Thessaly to the sites of Sykourio and Elateia. Finally, a tool made of andesite is definitely from a distant source, because volcanic rocks are not found in Central Greece.

¹⁰ Melfos and Stratouli 2016.

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