Neolithic Polished Stone Artifacts: A Study of Sourcing and Mobility in Alentejo Region, Portugal

Sissay Fikeru[1,2], José Mirão[2], António Valera[3,4], Massimo Beltrame[2], José Roseiro[2] Anna Tsoupra[2] Noel Moreira[3,6], Patrícia Moita[2,]

[1]University of Calgary, [2]University of Évora. [3]Era Arqueologia, Núcleo de Investigação Arqueológica. [4]Universidade do Algarve

fikeru.sissay@ucalgary.ca

Abstract: This study examines the sourcing of amphibolite polished stone artifacts from Late Neolithic–Chalcolithic contexts at the Perdigões archaeological complex. The study analyzed archaeological artifacts alongside geological samples collected from the broader region, for straightforward comparison. Petrographic, mineralogical, and geochemical analyses reveal a clear mismatch between the artifacts and the geological samples collected within a 60-kilometer radius, indicating that the raw materials were not obtained from nearby sources.

Background

Late Neolithic-Chalcolithic is a critical period, where Southwest Iberian societies were engaged in a strong social complexity, influenced by inter and intra-regional interaction (Valera, 2017; Lopez and Gomes, 2021). The characterization of raw materials in archaeology advanced our understanding of Neolithic-Chalcolithic societies and allowed us to identify sources and mobility patterns. This research aims to study the sources of amphibolite polished stone artifacts from the Perdigões archaeological complex in the Alentejo region, Portugal (Valera, 2017). The Perdigões complex (Reguengos de Monsaraz) is a well-preserved archaeological complex from the Neolithic-Chalcolithic period (3400-2000 BC) in the southwestern Iberian Peninsula. It served as a major ritual center and a social hub within a network of settlements, encompassing a necropolis, and megalithic ceremonial enclosure (Žalaitė et al., 2018; Valera, 2017; Valera et al., 2014). Amphibolite is a dark greenish-gray metamorphic rock formed by regional orogenic metamorphism of basic rocks. Primarily composed of hornblende and plagioclase, it also contains mica, quartz, garnet, and other minerals (Abbott and Bandy 2008; Sorensen 1988), often used for stone tool production in the late prehistoric Iberian sites (Lillio, 2000; 1997; Cardoso, 2014; Dominguez-Beakera et al., 2004).

Materials and Method

A total of 15 amphibolite polished stone artifacts and 16 geological specimens were systematically characterized using complementary techniques, including petrographic analysis, X-ray powder diffraction, and X-ray fluorescence. The geological samples were collected from several outcrops, including those mapped by Carvalhosa and Zbyszewski (1991), green rocks from the Moura Phyllonitic Complex (MPC) and Carvalhal Formation (CAF), within a 60 km radius of Perdigões in the Ossa-Morena Zone (OMZ) (Julivert 1974; Araujo et al. 2005).

Results and Discussion

Optical microscopic observation of polished stone artifacts revealed that they are primarily composed of coarse-grained, weakly metamorphosed amphibolitic and greenschist rocks. Petrographic analysis further identified a considerable presence of amphibole and plagioclase, showing variations in grain size. On the other hand, geological samples revealed greenschist facies, characterized by chlorite, epidote, alkali feldspar, metamorphic amphibole of varying grades, and later-stage carbonates. The X-ray powder diffraction reveals similar mineral assemblages within each group and among different groups of the artifacts; amphibole, feldspar, epidote, and chlorite are common phases, albeit in varying quantities. Alternatively, the diffractogram of the geological samples unequivocally reveals a predominance of chlorite, quartz, calcite, and mica, with only marginal amounts of alkali feldspar, sphene, amphibole, and plagioclase. The geochemical results indicate that scatterplots of major and trace elements display a dispersed pattern for both artifacts and geological samples, without a clear geochemical signature linked to artifact groups or geological context, even though trace element distribution plots show some dispersion with partial group overlap.

Conclusion

In conclusion, the source of the raw materials for the Perdigões polished stone artifacts remain unidentified, as petrographic, mineralogical, and elemental analyses revealed no significant correlation with either local or regional geological sources. These results, alongside prior research (e.g. Valera, 2017), provide compelling evidence that Neolithic groups in southwestern Iberia involved in long-distance interactions and exchange networks, demonstrating patterns of increasing social complexity as time passed.

References

Araújo, A., Fonseca, P., Munhá, J., Moita, P., Pedro, J., & Ribeiro, A. (2005). The Moura Phyllonitic Complex: an accretionary complex related with obduction in the Southern Iberia Variscan Suture. *Geodinamica Acta*, *18*(5), 375-388. https://doi.org/10.3166/ga.18.375-388.

Cardoso, J. L. (2004). Polished stone artifacts at the prehistoric settlement of Leceia (Oeiras). *Sonderdruck ans Madrider Mitteilungen*, 1-32.

Carvalhosa, A., & Zbyszewski, G. (1991). Notícia explicativa da folha 40-B, Reguengos de Monsaraz. Serviços Geológicos de Portugal.

Dias, M. I., Prudêncio, M. I., & Valera, A. C. (2017). Provenance and circulation of Bell Beakers from Western European societies of the 3rd millennium BC: The contribution of clays and pottery analyses. *Applied Clay Science,* 146, 334-342. https://doi.org/10.1016/j.clay.2017.06.026.

Domínguez-Bella, S., Calado, D., Cardoso, J. L., Clop, X., & Tarriño, A. (2004). Raw materials in the Neolithic-Aeneolithic of the Iberian Peninsula. *Geological Survey of Slovak Republic*, *10*(1-2), 17-42.

Lillios, K. T. (2000). Un enfoque biográfico para la Etnogeología de la Prehistoria Final en Portugal. *Trabajos de Prehistoria*, *57*(1), 19-28. https://doi.org/10.3989/tp.2000.v57.i1.259.

Lillios, K. T. (1997). Amphibolite tools of the Portuguese Copper Age (3000–2000 BC): A geoarchaeological approach to prehistoric economics and symbolism. *Geoarchaeology: An International Journal*, *12*(2), 137-163 https://doi.org/10.1002/(SICI)1520-6548(199703)12:2%3C137.

Valera, A. C. (2017). The" exogenous" at Perdigões: approaching interaction in the late 4th and 3rd Millennium BC in Southwest Iberia. *In Key resources and sociocultural developments in the Iberian chalcolithic (pp. 201-224).* Tübingen Library Publishing.

Valera, A. C., Silva, A. M., & Romero, J. E. M. (2014). The temporality of Perdigões enclosures: absolute chronology of the structures and social practices. SPAL-Revista de Prehistoria y Arqueología, (23), 11-26. https://doi.org/10.12795/spal.2014i23.01.

Valera, A. C., Silva, A. M., & Romero, J. E. M. (2014). The temporality of Perdigões enclosures: absolute chronology of the structures and social practices. *SPAL-Revista de Prehistoria y Arqueología*, (23), 11-26. https://doi.org/10.12795/spal.2014i23.01.

Žalaitė, I., Maurer, A. F., Grimes, V., Silva, A. M., Ribeiro, S., Santos, J. F., ... & Valera, A. C. (2018). Diet and mobility of fauna from Late Neolithic–Chalcolithic site of Perdigões, Portugal. *Journal of Archaeological Science: Reports*, *19*, 674-685. https://doi.org/10.1016/j.jasrep.2018.03.033.