

1. INTRODUCTION

Geochemical characterization of flint is an analysis frequently used by archaeologists in their study of flint provenance in archaeological contexts. While flint deposits from northern Croatia were analysed geochemically in the last several decades by geologists (for example **HALAMIĆ ET AL. 2005, PEH & HALAMIĆ 2010**), there have not been any such analysis done on flint from the Istrian peninsula. There are several **primary** and **secondary deposits of flint** in the Istrian peninsula which were used frequently during prehistory.

2. THE SITE AND THE METHODOLOGY

Kargadur is an **Early and Middle Neolithic** site in southern Istria, Croatia, 12 km away from Pula (KOMŠO 2006). The flint artifacts from the site were macroscopically analyzed considering raw materials used, and the two sampled artifacts, **U-1** and **U-2** (figs. 1 and 2), were determined as having been made from Vižula and Marlera raw material, respectively. Therefore, we also sampled one flint sample from each of the flint deposits on Vižula and Marlera to compare the results. All the samples were analysed using **ICP-OES** (Inductively coupled plasma optical emission spectrometry) and **ICP-MS** (Inductively coupled plasma mass spectrometry) analysis in Bureau Veritas Commodities Canada Ltd in Vancouver, Canada, which provided us with data on **major oxides, major, minor, and trace elements**. Even though we realize four samples are not enough for a detailed study on the geochemical characterization of Istrian flint deposits, we nevertheless believe our data is a good starting point for other geochemical analyses. Moreover, more geochemical data on samples from the Vižula and Marlera deposits are forthcoming.

3. RESULTS AND DISCUSSION

As was expected, the four flint samples mostly consist of **SiO₂**, ranging from 96.39% to 97.28%. Other dominant major oxides present are **Al₂O₃** and **Fe₂O₃** (table 1). The different contents of elements **Ni** (nickel) and **Mo** (molybdenum) stand out and could point to a different and **characteristic geochemical fingerprint** of the two deposits (table 2, figs. 3 and 4). This hypothesis needs to be verified with geochemical analysis of a larger group of samples.

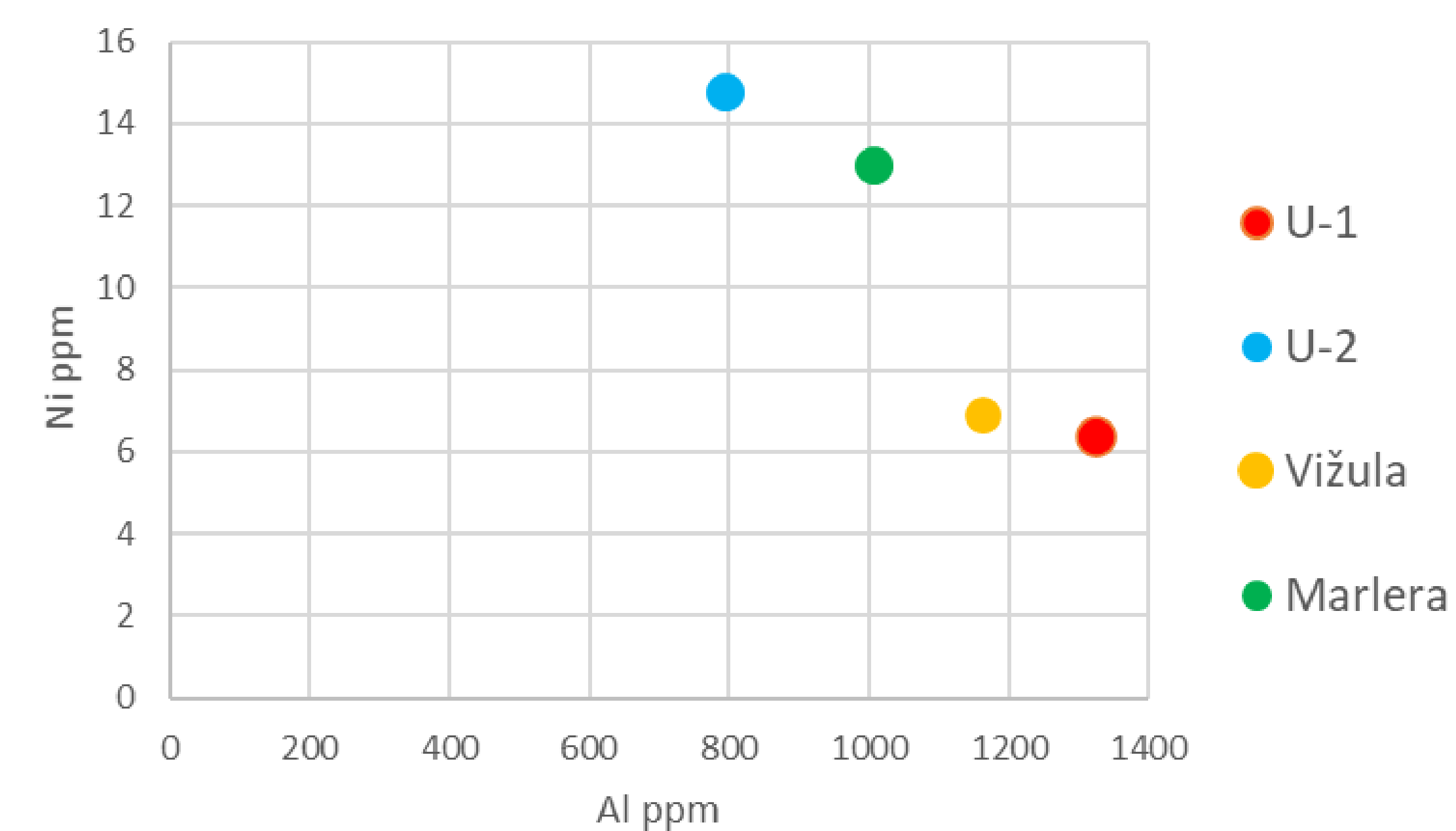


Fig. 3. Scatter diagram of **aluminium (Al)** and **nickel (Ni)** ratio in parts per million.

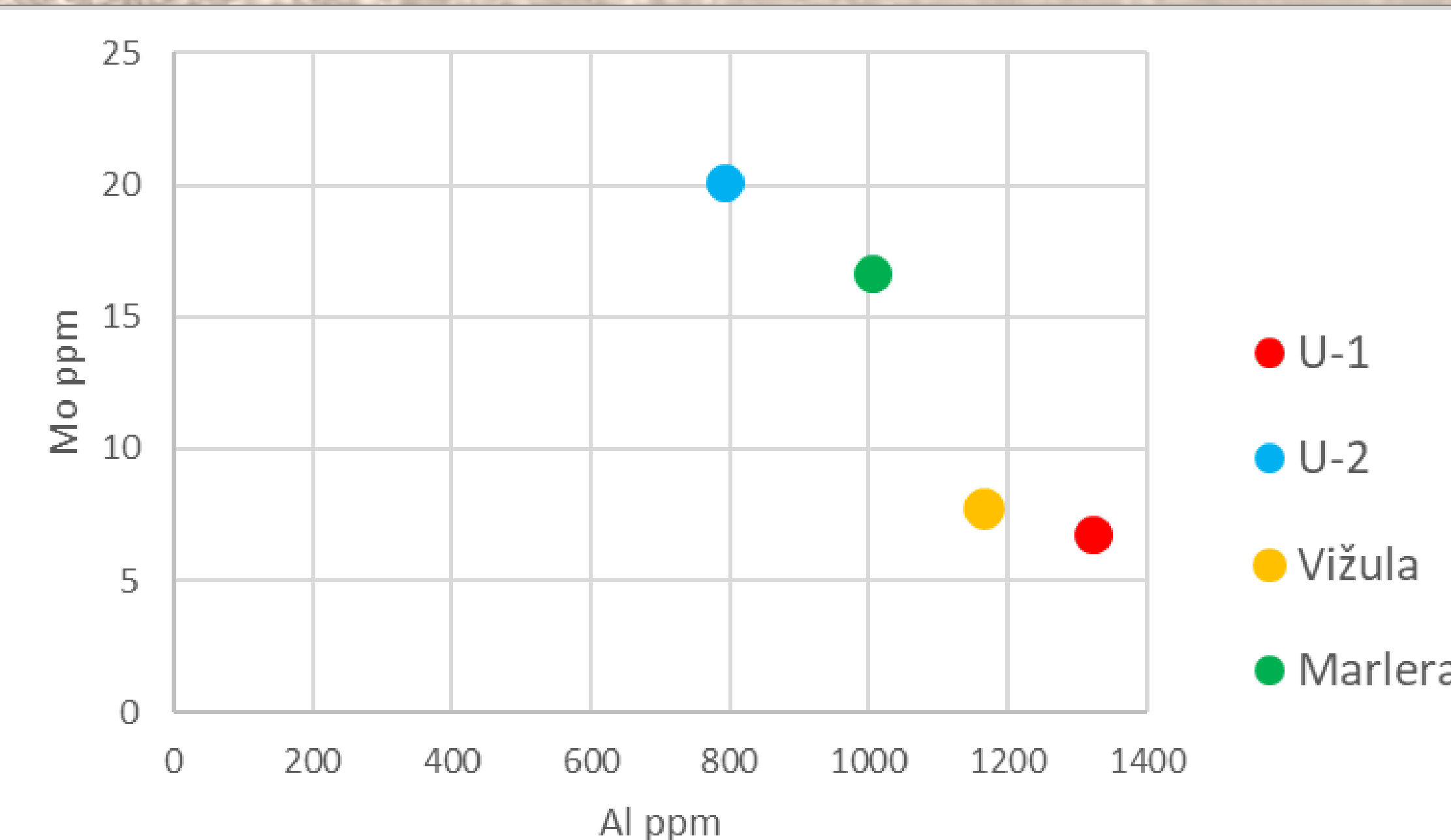


Fig. 4. Scatter diagram of **aluminium (Al)** and **molybdenum (Mo)** ratio in parts per million.

%	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO
U1	0.25	1.24	0.03	0.09
U2	0.15	1.92	0.02	0.10
Vižula	0.22	1.26	0.05	0.03
Marlera	0.19	2.38	0.01	0.05

Table 1. Major oxides data in all four samples.

ppm	Al	Ni	Mo
U1	1323	6,4	6,8
U2	794	14,8	20,1
Vižula	1164	6,9	7,8
Marlera	1005	13	16,7

Table 2. Aluminium (Al), nickel (Ni) and molybdenum element content in parts per million.

Reference material	Oxide/Element	Recovery (%)
SO-19	Al ₂ O ₃	101
SO-19	Fe ₂ O ₃	101
SO-19	MgO	102
SO-19	Ni	100
OREAS262	Mo	88
DS11	Mo	109

Table 3. Reference material recovery (n=2).

HALAMIĆ, J., MARCHIG, V., GORIČAN, Š. 2005. Jurassic radiolarian cherts in north-western Croatia: geochemistry, material provenance and depositional environment, *Geologia Carpathica* 56 (2), 123-136.
KOMŠO, D. 2006. Kargadur – eine Siedlung aus dem frühen- und mittleren Neolithikum Istriens, *Mitteilungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte* Bd. 27, 111-118.
PEH, Z., HALAMIĆ, J. 2010. Discriminant function model as a tool for classification of stratigraphically undefined radiolarian cherts in ophiolite zones, *Journal of Geochemical Exploration* 107, 30-38.

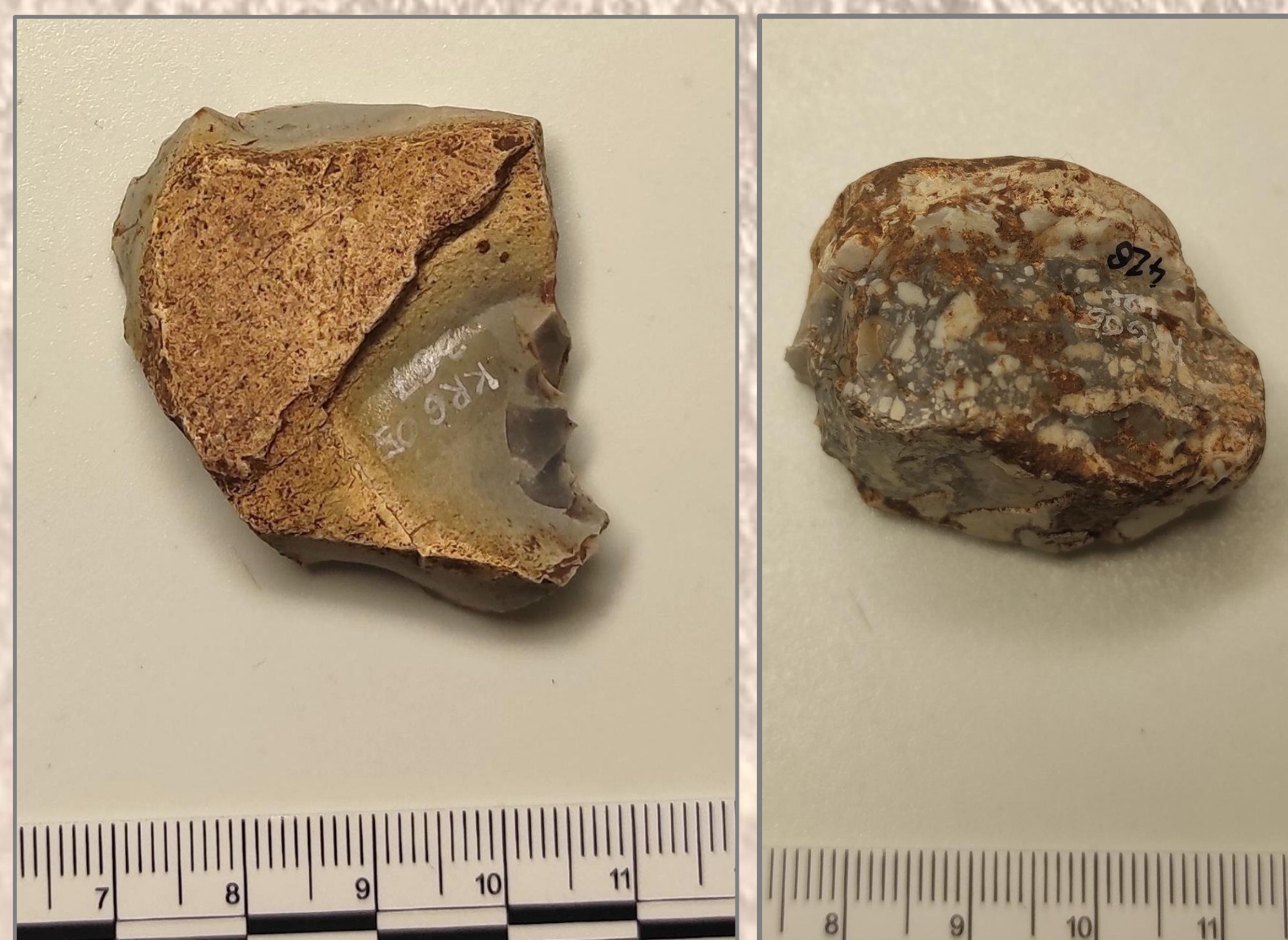


Fig. 1. U-1 flint sample.

Fig. 2. U-2 flint sample.

4. CONCLUSION

The data presented here can be regarded as the first geochemical data on any flint deposit from Istria, Croatia, that we know of. We analysed four flint samples, two of which come from an archaeological context – the Neolithic site of Kargadur in southern Istria. The elemental content of Ni and Mo could point to a characteristic geochemical fingerprint of the Vižula and Marlera deposits. However, for the analysis to have a higher statistical significance, it is necessary to analyse a larger group of samples.

ACKNOWLEDGEMENTS

The authors would like to thank **Duje Kukoč**, PhD, for the helpful discussion regarding the results of this analysis. We would also like to thank **Darko Komšo**, the director of the Archaeological Museum of Istria in Pula, for the permission to analyze the flint artifacts.

¹ PhD candidate, Juraj Dobrila University of Pula, Croatia, Faculty of Humanities, Department of Archaeology, Centre for Interdisciplinary Research in Landscape Archaeology, katarina.sprem@unipu.hr

² mag. chem., Croatian Institute of Public Health, Zagreb, Croatia, Metals and metalloids unit, bernardo.marcius@hzjz.hr.