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## The Use of Scanning Electron Microscopy for In-situ Identification of Gold and Palladium Minerals from Čukaru Peki Deposit, Eastern Serbia

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The Čukaru Peki hydrothermal system is one of the largest porphyry Cu-Au deposits discovered in Europe in the 21<sup>st</sup> century. This system is genetically associated with the first magmatic phase of the Timok magmatic complex. It is a part of the Cretaceous ABTS metallogenic belt, which stretches from Apuseni mountains in Romania to Srednogie zone in Bulgaria.

Three distinct types of mineralization can be distinguished in Čukaru Peki: 1) Porphyry zone (also known as Lower zone) with chalcopyrite, pyrite and bornite is located in deeper parts of the hydrothermal system; 2) Transitional epithermal zone (also known as Overprint zone) located between the porphyry zone and the high-sulfidation zone and 3) High-sulfidation zone (also known as Upper zone) consisting of massive sulfides with pyrite, covellite and enargite [1].

Previous mineralogical research of samples from Čukaru Peki, conducted by Rakita Exploration company, concluded that gold is present in different forms, including tellurides such as calaverite ( $\text{AuTe}_2$ ), sylvanite ( $\text{AgAuTe}_4$ ) and kostovite ( $\text{CuAuTe}_4$ ), and very fine-grained native gold. Gold minerals are mostly hosted in pyrite but also locally found encapsulated in bornite [2].

Research was conducted on polished samples from the Porphyry zone of Čukaru Peki taken from the drillhole FMTC1327. The samples were analyzed by reflected light microscope and SEM-EDX (ZEISS EVO 10 with Bruker X flash detector) at Montanuniversität Leoben, Austria.

Two micron-sized grains of gold-bearing minerals were discovered in sample number CP84. One grain found inside a larger pyrite grain contains 72 w.% (weight percent) Au and around 18 w. % Ag. Considering the amount of silver, this is probably a grain of electrum with around 4:1 Au-Ag ratio. The second grain found at the edge of a chalcopyrite grain contains 88,8 w.% Au and 4,25 w.% Ag. This grain represents native gold with a small amount of silver (Figure 1).

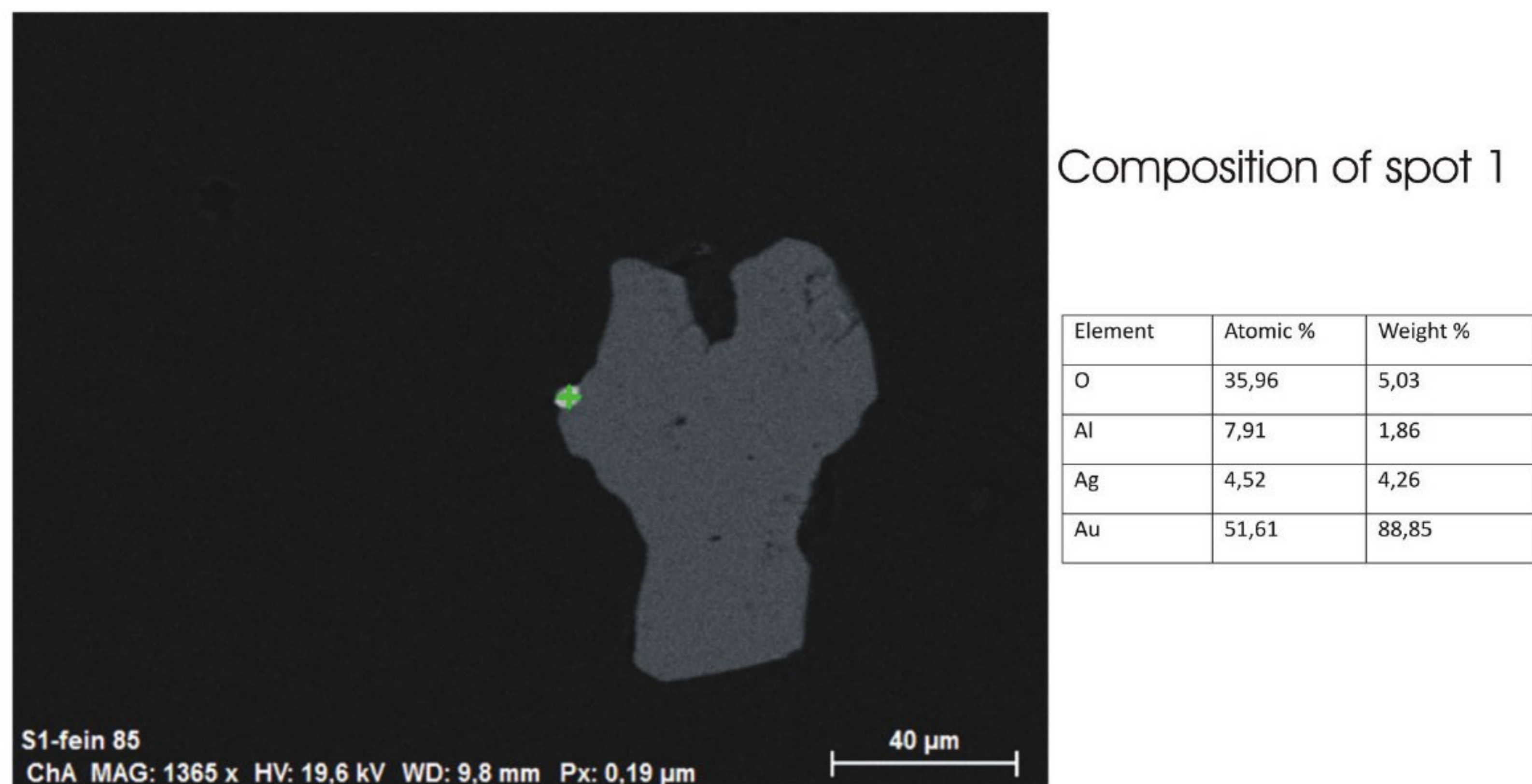
A very small grain of palladium telluride (less than one micron in diameter) was discovered in sample number CP88 at the edge of a pyrite grain. Considering the tiny size of the grain, the SEM analysis was not very precise. However, the analysis contains 4 w.% Pd and 26 w.% Te, so this mineral is most likely a palladium telluride, such as merenskyite or a similar phase (Figure 2).

The previous study of trace elements in pyrite from Čukaru Peki [3] implies that pyrite from the Porphyry zone of Čukaru doesn't contain detectable concentrations of Au, Ag and

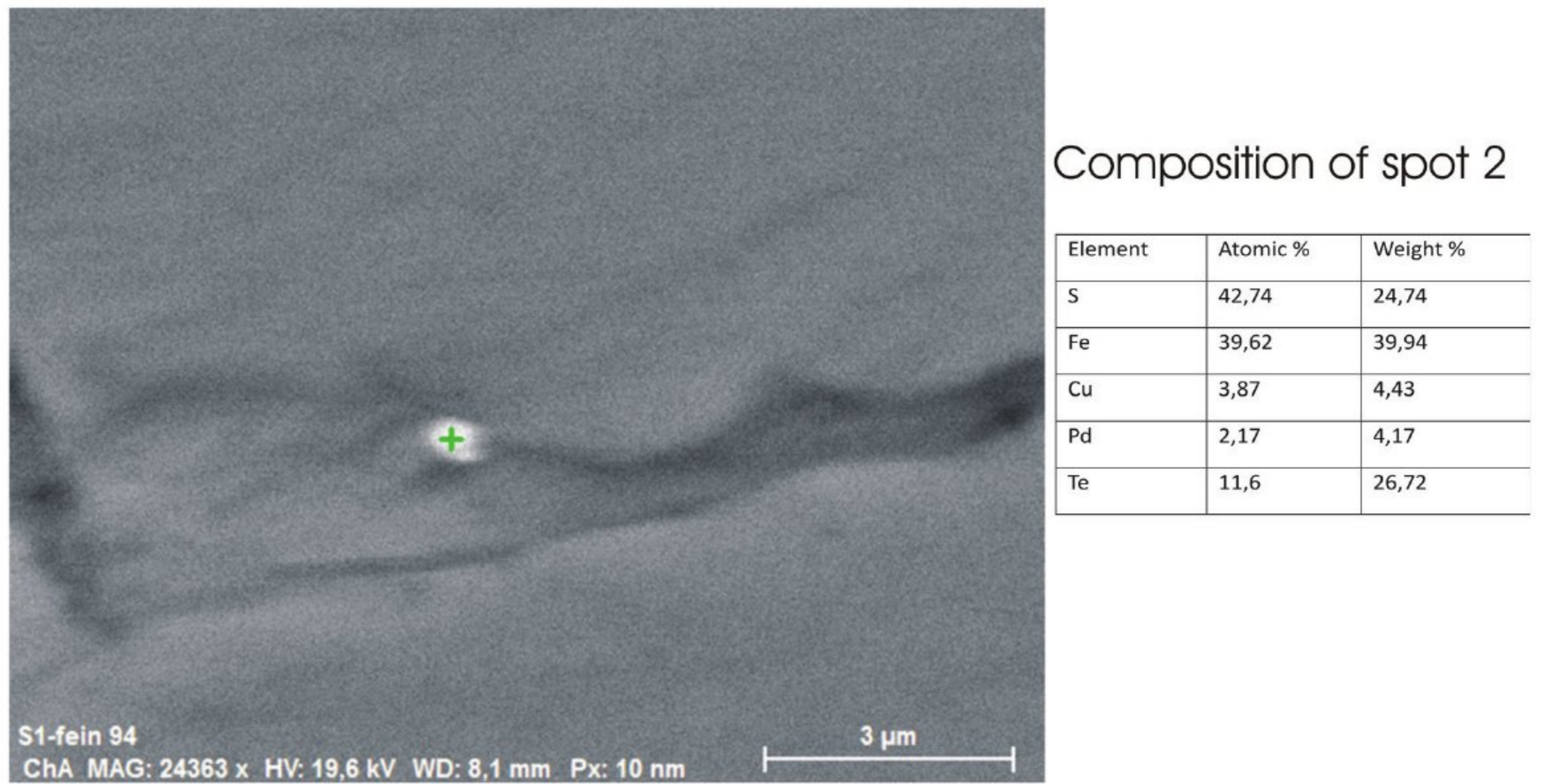
Pd. Considering this, it can be concluded that these elements are probably not incorporated in pyrite or other minerals, but rather form separate micron-sized mineral phases, such as the ones discovered in this research: native gold, electrum and telluride minerals. This research can thus be useful in designing the methods of extraction of precious metals from the ore in the porphyry zone of Čukaru Peki [4].

#### References:

- [1] R. Jelenkovic *et al*, *Geologia Croatica* **69** (2016) p.143-155.  
 [2] J. Jakubec *et al*, Technical Report, Nevsun Resources Ltd NI 43-101 (2018) p. 1-427.  
 [3] M. Velojic *et al*, *Geologia Croatica* **75** (2022) p. 303-316.  
 [4] This research was supported by the Science Fund of the Republic of Serbia, GRANT No TF C1389-YF, GEODYNAMICS OF BASINS ABOVE SUBDUCTED SLABS: an integrated modelling study of tectonics, sedimentation, and magmatism in the Timok Magmatic Complex – TMCmod (PROJECT No 7461). This research was also supported by the Ministry of Science, Technological Development and Innovation of Serbia, contract number 451-03-65/2024-03/200126. This research was partly funded by an Ernst Mach Grant by OEAD agency and CEEPUS mobility grant.



**Figure 1.** BSE image and composition of a small gold grain found in sample CP084.



**Figure 2.** BSE image and composition of a small palladium telluride grain found in sample CP088.