Mineralogical, ore-microscopic and geochemical comparative study of Fe-Ni-ores of Lokris area (Central Greece)

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Nickeliferous iron ores (Fe-Ni-ores) located in the area of Lokris (Central Greece) is exploited by Larko A.G. Company. With an annual production of over than 18000 tons of nickel, Larko is ranked as one of the most important European nickel producers. In this study the Fe-Ni-ores of Agios Ioannis, Marmeiko and Tsouka deposits are compared according to their mineralogical, ore-microscopic and geochemical characteristics.

The examined Fe-Ni-ores, formed from lateritic weathering of ophiolithic complexes of the subpelagonian unit of Greece, to which the Lokris area belongs, are oolithe/pisolithe type. They consist of ooids, pisoids, peloids and abrasioliths (fragments of ooliths). Their major mineralogical constituents are hematite, goethite with minor quantities of kaolinite. Additionally in the Fe-Ni-ores chromite, Al-spinels are also present, while Ni-minerals (Nimite, Willemseite, Nepouite, Takovite) and Mn-minerals were found in minor quantities. The Fe-Ni-ores of Agios Ioannis and Marmeiko forms beds, which are placed on the karstificated limestones of Jurassic, while Tsouka ore deposit which also form beds, is placed on ultrabasic rocks. All three deposits are overlaid by transgressive sediments of the Cretaceous. The presence of fragments of ooids, clastics and abrasioliths, in the deposits of Agios Ioannis and Marmeiko, indicates redeposition of the Fe-Ni-ores. Both deposits are considered as secondary heterochthone formations. Contrary in the deposit of Tsouka the occurrence of a limited number of abrasioliths as well as the absence of inclusions of fragments of oolits, indicates that a small transport and redeposition of the clastic components of the ooliths has occurred. The deposit of Tsouka is considered as a secondary pseudoautochthones deposit, having characteristic underlying laterite units. The correlation of the geochemical data of the deposits of Agios Ioannis and Tsouka showed that the ores formed from ultrabasic parent rocks. The relatively higher contents of Al and Ti as well as the occurrence of, Al-spinels, ilmenite with its replacement products (pseudorutile and leucoxene), anatase and magnetite, in the ores of Marmeiko, are signs for the fact that beside ultrabasic, also basic rocks were involved in the structure of the parent rocks.

Nd isotopes in Archean water masses: The importance of mantle- versus continentally-derived inputs

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The 2.9 Ga Pongola Supergroup (South Africa) contains shallow water banded iron-formation (IF) that possesses a primary seawater signature, and displays Nd isotope values indistinguishable from contemporaneous shale ($\varepsilon_{Nd}(t)$ between -2 and -4). The distinctly negative $\varepsilon_{Nd}(t)$ of the Pongola IF is atypical for many Archean IFs. Rare earth element distributions in the Pongola IFs vary as a function of relative water depth (as suggested by a transgressive-regressive cycle of IF deposition), and these observations indicate that shallow seawater along continental margins in the Archean was heavily influenced by inputs from continental weathering.

This scenario for the Pongola Supergroup is examined using data from contemporaneous IFs from the 2.9 Ga Pietersburg Greenstone Belt (South Africa). Whereas the Pongola IFs formed on a stable cratonic margin, the Pietersburg Greenstone Belt is not associated with pre-existing cratonic crust. Pietersburg IF samples display rare earth element distributions indistinguishable from older Isua IFs (3.8 Ga, Greenland) and younger Kuruman IFs (2.5 Ga, South Africa), and are consistent with primary seawater precipitates. Nd isotope signatures for the Pietersburg IFs are less negative ($\varepsilon_{Nd}(t)$ between -1 and 0) than contemporaneous shales and the coeval Pongola IFs. Therefore, it appears that Archean seawater was inhomogeneous with respect to Nd isotopes, similar to modern oceans. These data, and the contrasting depositional environments of the Pongola and Pietersburg IFs, suggests the presence of mantle-derived Nd in Archean open-ocean seawater, whereas coastal waters were dominated by continental Nd.