Genesis and epigenetic evolution of the Minjera bauxites, Croatia, Istria

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ljena biometrijska analiza kućica ove vrste (CORDEY *et al.*, 1970), stoga su procedura i odabir mjerenih parametara uglavnom slijedili metodologiju opisanu tim radom. 50 kućica vrste P. micra nasumično je odabrano i fotografirano s bočne i spiralne strane. Svakoj kućici izmjeren je najveći promjer, visina i širina najmlađe klijetke, te broj klijetaka u zadnjem zavoju. Uz to identificiran je tip ušća, koje kod ove vrste varira od visokog luka do bipartitnog, podijeljenog na dva luka.

Mjerenjem je utvrđeno da u svim istraženim uzorcima prosjek maksimalnog promjera kućice iznosi od 140,3 do 159,9 μm, što je manje od holotipa (170 μm). Najmanji maksimalni promjer kućice imaju u uzorku iz zone E15, u starijem dijelu naslaga uvale Zaraće, a to je ujedno i uzorak u kojem ova vrsta ima najveću zastupljenost u zajednici (11,3 %). Širina i visina najmlađe klijetke variraju neovisno o ostalim mjerenim parametrima dok je prosječan broj klijetaka u zadnjem zavoju ujednačen, krećući se između 6,2 i 6,4. Bipartitan tip ušća je vrlo rijedak, te niti u jednom uzorku broj jedinki s ovakvim ušćem ne prelazi 4 %. Ovi rezultati ukazuju da je *P. micra* u sutropskim do umjerenim uvjetima kakvi su vladali tijekom gornjeg eocena na prostoru današnjeg otoka Hvara, imala kućice manjih dimenzija od pripadnika iste vrste iz tropskih područja.

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GENESIS AND EPIGENETIC EVOLUTION OF THE MINJERA BAUXITES, CROATIA, ISTRIA

GENEZA I EPIGENETSKI RAZVOJ BOKSITA MINJERE, HRVATSKA, ISTRA

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Pyritisation of bauxites occurs as a result of their epigenetic reduction during the formation of swampy environments in the bauxite cover during the initial phase of the transgression, which commonly follows the formation of the bauxite. The Minjera bauxites, which formed during the terrestrial phase which lasted between the Late Cenomanian/Late Santonian and Early Eocene, were pyritised. The epigenetic pyritisation of these bauxites was related to the transgression that followed their formation, which led to the formation of ponds and swamps in the paleo-depressions in the karstified terrain, such as the sinkholes and canyons filled with the bauxite. Therefore, all of the Minjera bauxite bodies are covered by Lower Eocene Liburnian beds formed in such environments.

The Minjera bauxites have been mined in the past, but only the pyrite-containing bauxite was used in the production of alum and vitriol, while the red bauxite was left in the tailing heaps in the area. Pyritised bauxite samples from two Minjera bauxite bodies (D-1 and D-15) were collected, with the aim to reconstruct their genesis and the processes which led to their formation and subsequent pyritisation. Two main types of bauxites, the grey bauxite and the pyritised bauxite, were distinguished based on their mineralogy, geochemistry as well as their structure and texture. The grey bauxite contains high amounts of kaolinite and moderate to high amounts of diaspore, while containing no or little böehmite. Iron sulphides, represented mainly by pyrite and sporadically by marcasite, are generally present in very low amounts in this type of bauxite and appear as veinlets and crystal clusters in the matrix and bauxite clasts and as replacements of iron oxide rich laminae in ooids. This type of bauxite is also enriched in bases and large ion lithophile elements compared to pyritised bauxite, which is likely related to lower leaching intensity. Pyritised bauxite contains high amounts of böehmite and iron sulphides, while containing very little to moderate amounts of kaolinite, and almost no diaspore. Iron sulphides appear in these samples in many different morphologies and textures. They replace the iron oxide-rich laminae within the ooids and the fine-grained matrix between the bauxite clasts and ooids. In samples where the matrix was not completely pyritised, the pyritisation started from many crystallisation centres, from which iron sulphides grew outward, either in the forms of framboids or rosettes composed of needle shaped crystals. Iron sulphides in these samples commonly crystallize along the fractures, which is also seen on a large scale, in the form of centimetre-thick veins of iron sulphides parallel with the boundary between the bedrock and the bauxite. Both bauxites are enriched in heavy REEs, and display a slight negative cerium anomaly, which indicates the influence of marine porewater. Different textures and morphologies of iron sulphides suggest variations in the saturation with iron and sulphur and are probably linked with the sea-level variations during the initial stages of the transgression, which could have affected the production of organic matter in swampy environments that developed in the cover of the bauxite during this stage. The ingression of marine porewater was most likely the source of sulphur, which was derived from the microbial reduction of sulphur in the organic matter-rich environment. The pyritisation appears to have affected each bauxite deposit differently, since the grey bauxite is almost exclusively found in the D-15 deposit, while the pyritised bauxite is found only in the D-1 deposit. Besides their distinct epigenetic evolution, this also suggests that bauxites of different grades formed contemporaneously in the area, as the D-15 body is composed mainly from highly kaolinitic grey bauxite and the D-1 body from the highly böehmitic pyritised bauxite. This is probably related to different morphologies of the two bauxite bodies, as the D-1 body is much larger and steeper (> 20 m) than the D-15 bauxite body (< 5 m). The differences in their morphologies likely developed as a consequence of their different palaeotopographical positions, which led to different rates of chemical weathering between the two bauxite bodies.

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NON-KARST AREAS IN THE KARST AREA OF CROATIA
NEKRŠKA PODRUČJA NA PODRUČJU KRŠA RH

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Ključne riječi: *krš, GIS, poljoprivredna područja, ruralni razvoj, rekultivacija*

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Krško područje prikazano je i analizirano prema definiciji krša iz Izvješća o stanju u prostoru RH (2003).