

**KARST PHENOMENA AND THE ORIGIN OF
BAUXITE**

KRAŠKI POJAVI IN NASTANEK BOKSITA

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Izveček

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Pavlovec Rajko: Kraški pojavi in nastajanje boksita

V Zunanjih Dinaridih so dobri primeri odvisnosti nastajanja krasa in boksita, ki se je kopičil v depresijah na apnenčevi podlagi. Večina boksitnega gradiva izhaja iz preperelih apnencev.

Ključne besede: geologija, kras, rudna ležišča, boksit

Abstract

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The Outer Dinarids offer good examples of correlation as to the formation of karst and bauxite accumulating in the depressions on a limestone basement. Most bauxite material comes from limestones decay.

Key words: geology, karst, mineral deposits, bauxite

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Slovenija

Bauxite may appear as a result of magmatic and metamorphic rock decay. However, aluminosilicates play a very important role in the process. On the other hand, bauxite may form from limestone, as well as from marl and claystone, if the latter contains a sufficient proportion of clay minerals (M. Drovenik, 1984). Croatian geologists, namely M. Kišpatić, F. Tućan and L. Marić had limestone in mind, and terra rossa as an intermediate phase. Yet, pure limestone leaves over no more than 2% of insoluble residue, containing 0,04%

Al_2O_3 means that incredibly huge amounts of limestone would have had to dissolve to result in bauxite strata. Besides aluminium oxides, terra rossa comprises a rather high percentage of quartz - nearly up to 40%. Bauxite usually does not have that much, therefore quartz would be supposed to have got lost somewhere in the course of bauxitisation. The bauxite ores in Herzegovina, at Lištica, for example, contain 2 to 11% of quartz and 44 - 54% of Al_2O_3 while those in the area of Imotski have less than 1% of quartz in some places, 16% being the greatest quantity, the presence of Al_2O_3 ranges between 40 to 60%, though (K. Sakač et al., 1984; K. Sakač et al., 1987).

The whole problem should be considered from another point of view as well. The majority of bauxite in Herzegovina, Dalmatia and Istria lies on a Cretaceous and Paleogene paleorelief (cf. M. Knez & R. Pavlovec, 1990). Here and there, bauxite appears on clastic structures, too, yet researches point to a transmission and subsequent processes in moors or in the sea (K. Sakač et al., 1984). The bauxite from the area of Drniš and other parts of Dalmatia disposes even of sea fossils (R. Pavlovec, 1959; K. Sakač, 1966). This fact could be regarded as a reliable proof for the bauxite mass having been transmitted to the sea, sustained furthermore by the occurrence of the underlying and overlying marine beds.

Let us have now a look at the bauxite lying on a paleokarstic relief. In the Outer Dinarids there are many cases lending themselves to a deliberation as to the origin of bauxite. In Istria the deposition of Cretaceous limestone led to an emersion, being followed by a karstification and the appearance of an uneven karstic surface as well as karstic caves (cf. G. Bignot, 1972; M. Knez & R. Pavlovec, 1990). Karstic forms are frequently filled with bauxite, which, as we may state now, undoubtedly appeared between the Upper Cretaceous period and Eocene, its position being secondary.

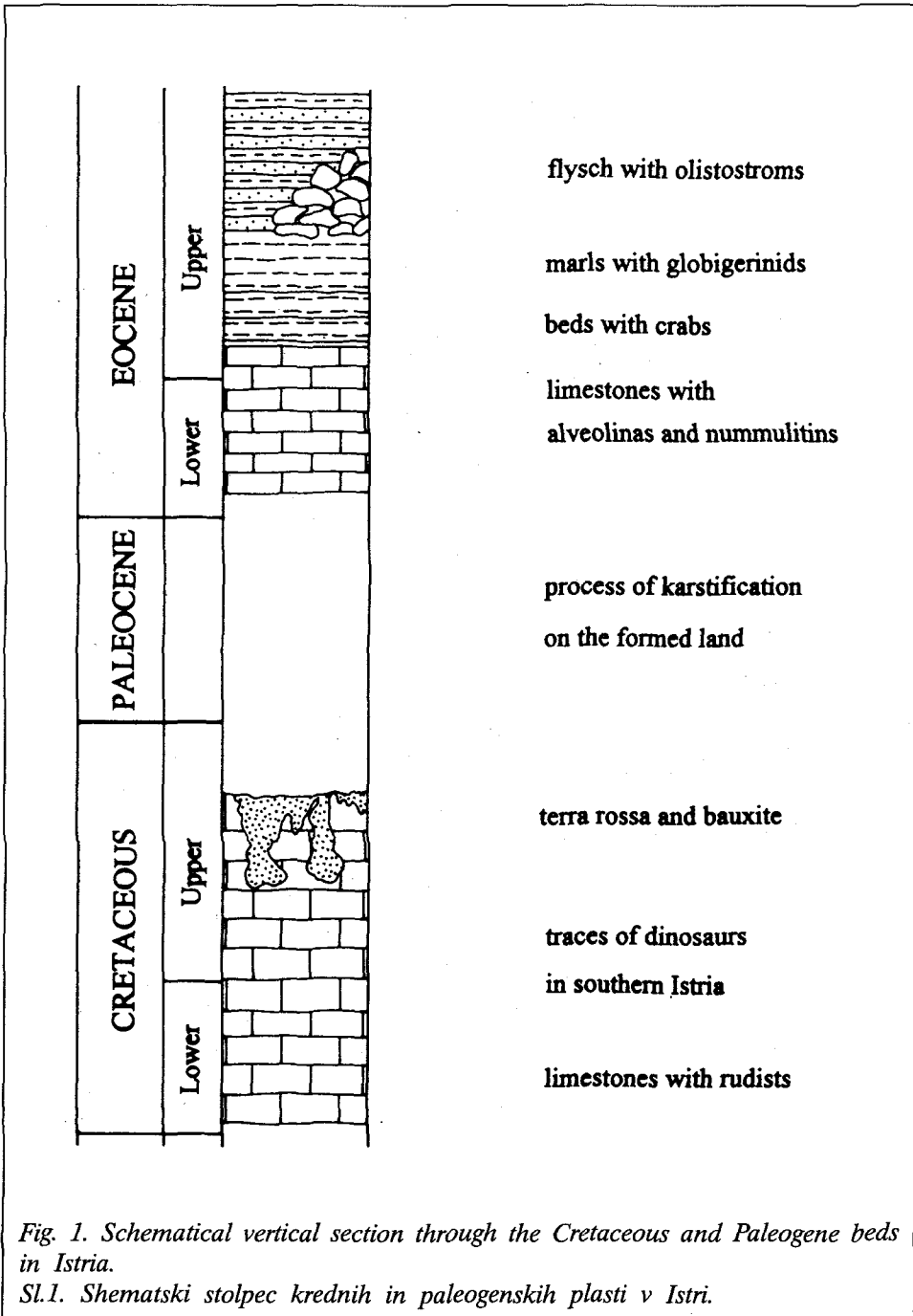


Fig. 1. Schematical vertical section through the Cretaceous and Paleogene beds in Istria.

Sl.1. Shematski stolpec krednih in paleogenskih plasti v Istri.

The bauxite genesis in Western Herzegovina was closely examined by Croatian geologists (K. Sakač et al., 1987; I. Dragičević et al., 1986). They came to the conclusion that the bauxite from the surroundings of Lištica had started appearing by the end of the Cretaceous period and continued up to the end of Paleocene or the beginning of the Eocene during a land phase, on a rather level mainland where physical decay of the carbonate basement used to be outdone by chemical decay. The bauxite mass was transmitted in the negative relief. The transmission could have been complex, with the bauxite however being simultaneously affected by various physical and chemical processes. The appearance of bauxite near the place Studena vrela has been given a similar explication.

Thus, a conclusion may be drawn, namely, the bauxite in the Outer Dinarids was not in its primary position. Yet, we must exclude the supposed transmission of material from the magmatic or metamorphic rocks, such sequences being absolutely nonexistent even far away from the present deposits of bauxite in Istria, Dalmatia and Herzegovina. Violent tectonic moves in the Outer Dinarids - having brought older rocks, such as tuffs and others, to the surface of the platform - were thought of (cf. M. Drovenik, 1984). On the islands, this material was to have brought about the appearance

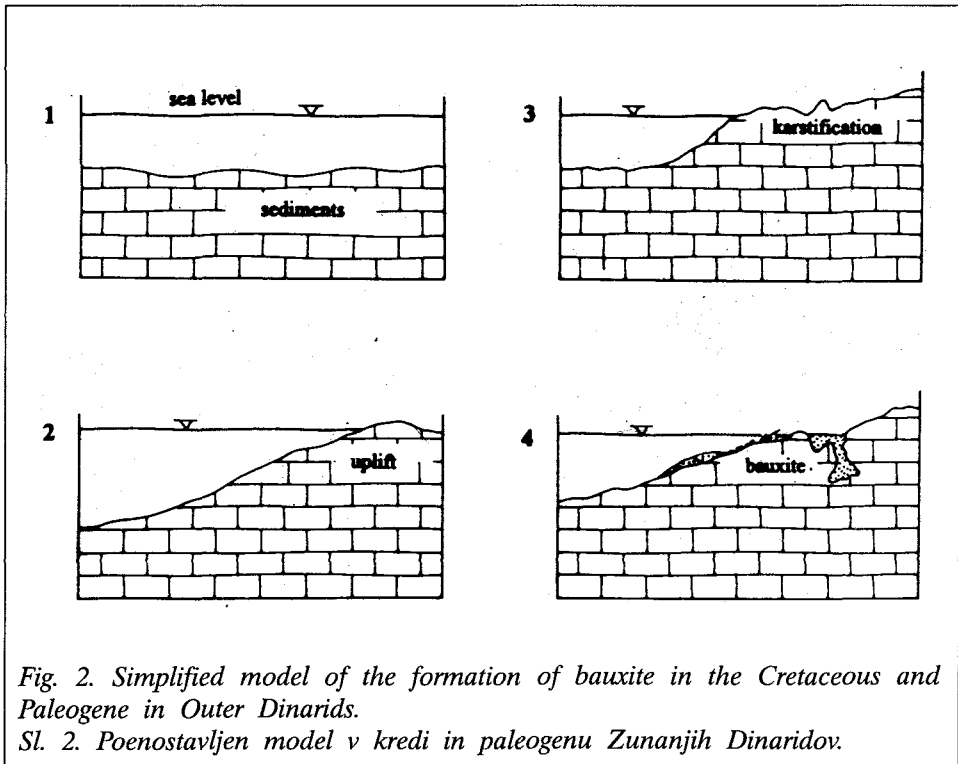


Fig. 2. Simplified model of the formation of bauxite in the Cretaceous and Paleogene in Outer Dinarids.

Sl. 2. Poenostavljen model v kredi in paleogenu Zunanjih Dinaridov.

of bauxite, later on washed off in a karstic relief. Yet, it is hardly believable that the majority of Cretaceous and Paleogene bauxite in the Outer Dinarids would have appeared in such a way, as there are no proofs of frequent moves of probably smaller bodies.

Because there is a comparatively small amount of insoluble residue left over in limestones of the Outer Dinarids we must consider the transmission of bauxite material from limestones, mostly, and to a lesser degree from other rocks; even the wind factor can not be totally neglected, though (cf. K. Sakač et al., 1987). The reason why bauxite used to accumulate only on karstified limestone surface and not on other rocks, can be explained by a karstic relief strongly expressed on limestones. Due to the fact that depressions or negative relief configurations, respectively, arose also as a result of tectonic moves on other rocks - usually devoid of bauxite - we may conclude as top the transmission of bauxite material from limestone rocks, not too distant, either.

Thus, we can draw logical inferences: In the Outer Dinarids bauxite occupies mostly the secondary places, its main origin being in the limestones. The transmission of the bauxite mass could not have been particularly long-lasting. We must, above all, keep in mind the washing off of the bauxite mass into funnels, abysses and other karstic forms.

Owing to the fact that bauxite deposits are to be found on the Cretaceous limestone with a Paleogene hanging wall strata, as well as inside the Paleogene limestones, we may come to the conclusion that the karstification occurred immediately after the emergence, should proper physical/chemical conditions, favourable to the appearance of karst, be given.

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Povzetek

Boksit nastaja ob preperevanju magmatskih ali metamorfnih kamnin ter apnenca, redkeje laporja in glinovcev. Ob preperevanju apnenca dobimo tako malo netopnega ostanka (okrog 2%, od tega okrog 0,04% Al_2O_3), da celotne jerovice in boksita ne moremo razložiti samo s tem procesom. Prav tako je vprašanje, zakaj je v boksitu znatno manj kremenca kot v jerovici, če bi proces potekal preko jerovice.

Ta probleme moremo dobro opazovati v Zunanjih Dinaridih, to je v Istri, Dalmaciji in Hercegovini. Tam je največji del boksita na krednem in paleogenskem paleoreljefu v apnenčevih kamninah (M. Knez & R. Pavlovec, 1990). Nekateri boksiti so bili preloženi v močvirja ali morja (K. Sakač et al., 1984), kjer so se včasih pomešali z morskimi fosili (R. Pavlovec, 1959; K. Sakač, 1966). Za naša razpravljanja so zlasti zanimivi boksiti na paleokraškem reljefu. V Istri je prišlo po odložitvi zgornjekrednih apnencev do dviganja in sledilo je zakrasevanje (cf. G. Bignot, 1972; M. Knez & R. Pavlovec, 1990). V eocenu je bila nova transgresija (K. Drobne, 1979). Paleokraški prostori so v Istri marsikje zapolnjeni z boksitom, ki je torej na sekundarnem mestu. Tudi drugod se je kopičila boksitna masa v negativnih reljefnih oblikah, prenašanje je bilo lahko večkratno (K. Sakač et al., 1987; I. Dragičević et al., 1986). Ker pa so magmatske ali metamorfne kamnine sorazmerno daleč proč od Istre, Dalmacije ali Hercegovine, lahko izvor boksita iščemo na preperelih apnencih.

Iz tega sledi, da je večina boksita v Zunanjih Dinaridih na sekundarnem mestu. Glavni izvor materiala je v apnencih. Transport boksitne mase ni bil posebno dolg in misliti moramo predvsem na spiranje v vrtače, brezna in druge kraške oblike. Ker je boksit sredi apnencev, lahko sklepamo, da je prišlo do karstifikacije takoj po umiku morja, če so bili za nastajanje krasa primerni fizikalno kemični pogoji.