HYPOTHESIS ON A GENETICAL RELATION BETWEEN THE ACTUAL KARST AND THE BAUXITE-BEARING PALEOKARST AT THE JURASSIC/CRETACEOUS BOUNDARY IN THE PIATRA CRAIULUI MOUNTAINS (ROMANIA)

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Field experience during drilling prospection for bauxite has revealed a constant distribution of the triad bauxite ore body-doline-overrall underground drainage direction. This seems to be the result of the "focalizing effect" of bauxite on karstification.

When air-drilling was introduced, in 1967, covered bauxite deposits exploitation in Romania became lucrative. As drilling prospection went on, a kind of legend grew among drillers : only the boreholes located close to a doline ("groapă" or "poșiștău" as they call it) would reach bauxite. Although some geologists accepted it, no reasonable explanation was available, so the legend was officially disregarded. However, statistics confirmed it : close to each bauxite lens a doline or a group of dolines was present. The reciprocal is not valid. Further observations revealed that the doline (dolines) is never above the bauxite ore deposit, but laterally, downstream in relation with the general direction of the underground drainage.

Such a constant distribution suggests a distinctive genetical legacy which is to be tried to be explained subsequently. But first some general geological information is needed :

The Upper-Jurassic supporting bauxite deposits is exclusively calcareous, with facieses varying from epicontinental to underlagunary. During Lower-Cretaceous they were subjected to karstification within a low-energy, high hydrostatic level plateau. Ashton and cenote type dolines were frequent. Massive oolithical alumino-ferruginous sediments almost filled the dolines. The total filling was provided by characaea limestones, highly bituminous with frequent iron sulphides in the lower levels. Faunal contents include characaeans, ostracodes and microgastropods. This suggests a freshwater lacustrine milieu, sometimes even swampy, with transition towards saltish, then marine in the upper parts.

Tectonics had little visible effects during that period. Only by the end of Cretaceous when banatites were emplaced, then during the emplacement of the Neogene volcanics, did tectonics markedly affect the bauxitic complex.

The Jurassic/Cretaceous interface is one of the major unconformities in the carbonaceous pile in Pădurea Craiului Mts. This stratigraphic discontinuity is lithologically stressed by bauxites and characaea limestones which have distinctive chemical characters in the carbonaceous pile. It is

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thus obvious that underground karstic drainages found and still find an ideal environment along this surface.

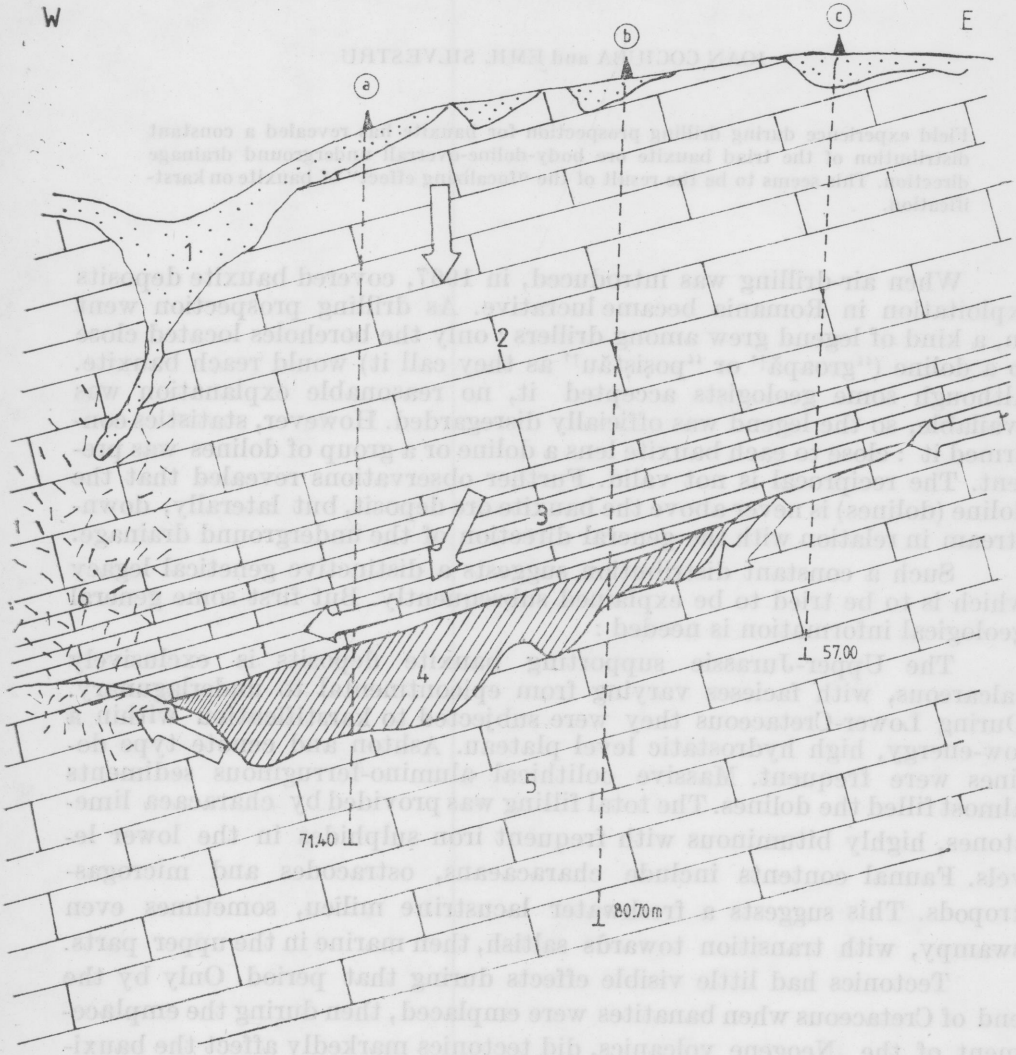

Fig. 1. — Geologic profile within a real bauxite ore body : 1. dolines and Quaternary filling ; 2. Cretaceous limestones ; 3. characaea limestones (Cretaceous) ; 4. bauxite ; 5. Jurassic limestones ; intensified karstification area ; a, b, c drillings ; arrows indicate water circulation.

Bauxite and the bituminous characaea limestones mark distinctive anisotropic entities both vertically (in the pile) and horizontally (along

the Jurassic/Cretaceous interface). This anisotropy has at least two important sides which can deeply influence karstification :

a. Permeability. Bauxites should be impervious as compared to limestones. However, given the intense tectonization of bauxites (which

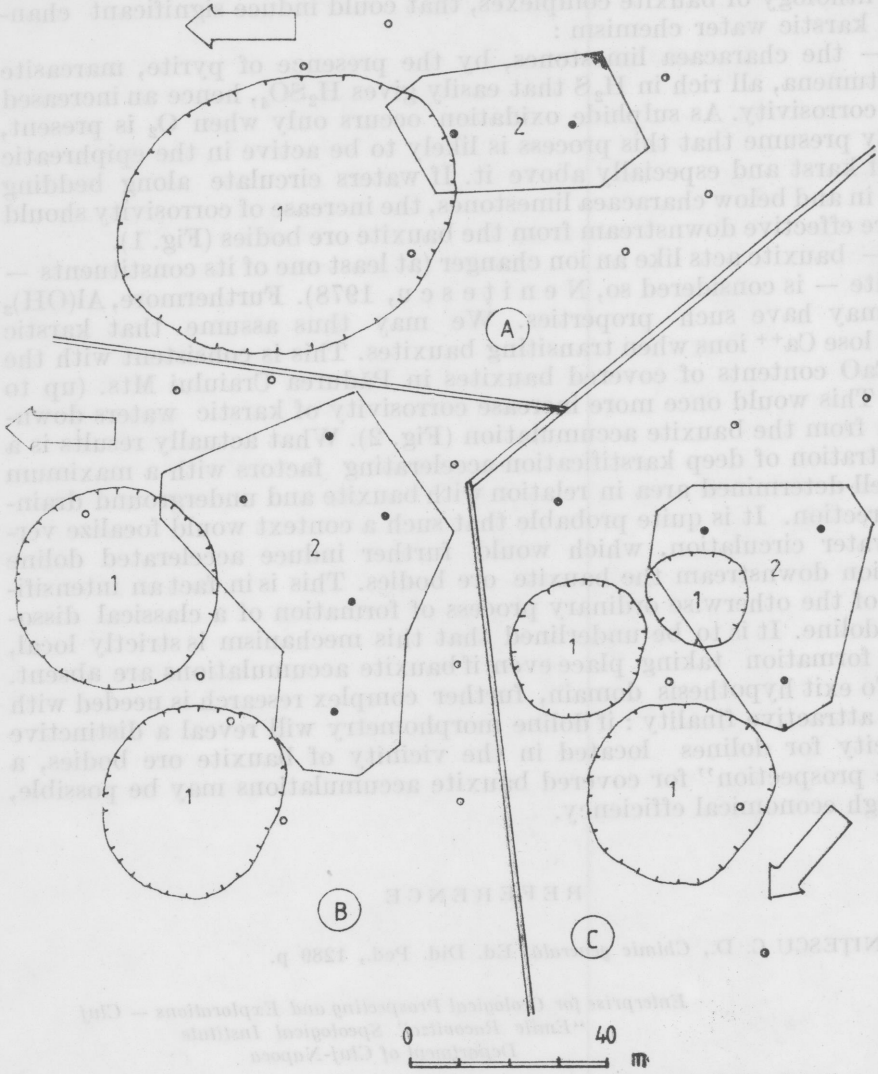

Fig. 2. — Three field examples of spatial distribution of the bauxite-doline-direction of underground drainage triad. Dots represent boreholes that reached bauxite ; circles are negative boreholes ; arrows indicate the direction of underground drainage ; 1. doline ; 2. bauxite lens.

unlike limestones do not fill fissures with secondary calcite) they are actually more permeable than limestones. On the other hand, characacea limestones, because of the shale partings and bitumena contents, are less permeable than the rest of the limestones. It is thus possible that they screen

out vertical water circulation, forcing bedding-plane circulation. That implies the waters reaching bauxite are mainly the ones circulating on bedding planes. For these waters, entering bauxite lenses means a higher turbulence (because of the labyrinthic trajectory they are forced to follow).

b. Chemism. There are two elements in the previous description of the lithology of bauxite complexes, that could induce significant changes of karstic water chemism :

— the characaea limestones, by the presence of pyrite, marcasite and bitumena, all rich in H_2S that easily gives H_2SO_4, hence an increased water corrosivity. As sulphide oxidation occurs only when O_2 is present, we may presume that this process is likely to be active in the epiphreatic zone of karst and especially above it. If waters circulate along bedding planes in and below characaea limestones, the increase of corrosivity should be more effective downstream from the bauxite ore bodies (Fig. 1).

— bauxite acts like an ion changer (at least one of its constituents — kaolinite — is considered so, N e n i ț e s c u, 1978). Furthermore, $Al(OH)_3$ itself may have such properties. We may thus assume that karstic waters lose Ca^{++} ions when transiting bauxites. This is consistent with the high CaO contents of covered bauxites in Pădurea Craiului Mts. (up to 10%). This would once more increase corrosivity of karstic waters downstream from the bauxite accumulation (Fig. 2). What actually results is a concentration of deep karstification-accelerating factors with a maximum in a well-determined area in relation with bauxite and underground drainage direction. It is quite probable that such a context would focalize vertical water circulation, which would further induce accelerated doline formation downstream the bauxite ore bodies. This is in fact an intensification of the otherwise ordinary process of formation of a classical dissolution doline. It is to be underlined that this mechanism is strictly local, doline formation taking place even if bauxite accumulations are absent.

To exit hypothesis domain, further complex research is needed with a very attractive finality : if doline morphometry will reveal a distinctive specificity for dolines located in the vicinity of bauxite ore bodies, a "doline prospection" for covered bauxite accumulations may be possible, with high economical efficiency.

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