PETROGRAPHICAL DIFFERENTIATION BETWEEN PALAEOZOIC OOLITIC IRONSTONES FROM FRANCE, BELGIUM AND GERMANY AND APPLICATION TO THE PROVENANCE STUDY OF ARCHAEOLOGICAL ARTEFACTS – PRELIMINARY RESULTS

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Samples of Palaeozoic oolitic ironstone beds susceptible of having being used as raw materials for Neolithic red ochres, have been petrographically investigated. The preliminary results of this first comparative analysis are quite encouraging: microfacies differences have been observed between Ordovician oolitic ironstones from Normandy (France), late Upper Devonian oolitic ironstones from Belgium and uppermost Lower Devonian to lowermost Middle-Devonian (Emsian-Eifelian) oolitic ironstones from the Eifel area (Germany).

Petrographical differentiation is based upon contrasting grain size, mineralogy (hematite/chlorite ratio) and typology of the ferruginous ooids, besides differences in mineralogy, diagenetic history and lithologic nature of the host sediments. Most conspicuous are differences in ferruginous ooid typology, including “true” concentric ooids, superficial ooids, algal oncoids and pseudo-ooids (ferruginized cortoids and rounded bioclasts). “Flax seed” or Clinton-type iron ores (rich in flattened ooids) and “fossil iron ores” (essentially composed of ferruginized bioclasts) can be identified as well as transitional or mixed types.

Homogenous and well-sorted, often flattened and fine-grained ferruginous “true” ooids (flax seed ore) with alternating hematite and chlorite cortices in a sideritic-chloritic or fine siliciclastic matrix, are characteristic for the Ordovician (Llanvirn) oolitic ironstones of Normandy (basal part of the Urville Shales). Locally, weathered levels exist, enclosing limonitic (goethitic) crusts. Medium-sorted, fine-to coarse-grained ferruginous hematitic pseudo-ooids (ferruginized bioclasts) in a bioclastic limestone matrix (fossil ore) characterize the Lower-Middle Devonian boundary oolitic ironstone beds (Heisdorf and Lauch Formations, Eifel Synclines). Finally, well- to medium-sorted heterogenous, fine- to medium-grained, pure or mixed flax seed- and fossil ore-type hematitic oolitic ironstones in siliclastic and/ore carbonate matrices, characterize the Belgian Latest Upper Devonian (Famennian) ironstone deposits (Hodimont Formation, Famenne Shales Group). Several stratigraphic levels do exist within the Lower Famennian and basal part of the Upper Famennian in the Namur, Dinant and Vesdre Synclinoria, but the lowermost Famennian one is the only level that has been mined. Within some of the younger Famennian oolitic ironstone levels, proximal and distal facies can be distinguished on the basis of microfacies differences and mineralogy of the ferruginous pseudo-ooids. Only the proximal hematitic facies of the lowest stratigraphical oolitic ironstone level (level I) is supposed to have been used in prehistoric times for the manufacturing of ochre.

Diagenetic sideritization and dolomitization, particle deformation as well as sulphide mineralizations, affect most of the studied oolitic ironstones. However, the intensity of these mineralizations varies strongly (even within the same deposit) and depends on local tectonics.

A distinction can be made between the Emsian-Eifelian and Famennian fossil iron ores, based on the nature of the bioclasts and other ferruginzed components). Eifelian oolitic ironstones contain ferruginized crinoids, bryozoans, trilobites, brachiopods, goniatites besides ferruginized siliciclastic intraclasts, whereas the Famennian ones are dominated by ferruginous ooids and algal oncoids, mixed with ferruginized bioclasts including crinoids, bryozoans, brachiopods, ostracods, algae and incertae sedis, and locally intraclasts (ferruginized stromatolitic crusts). Distal facies contain slightly Fe-impregnated bioclasts only such as crinoid ossicles and display a higher chlorite/hematite ratio.
Thin sections have been made in archeological objects (red ochre), allowing a first comparative petrographical analysis indicating their probable geological and geographical provenance.

References

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