Where and why: using a structural framework to contextualise and improve the understanding of processes leading to mineral occurrences

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The societal development towards climate neutrality and the ambition for economic growth and well-being in Europe rely on mineral raw materials. Mineral occurrences can be seen as manifestations of specific geological processes that happened in the subsurface, or geomanifestations. Locating and better understanding mineral occurrences and deposits in Europe is crucial for future informed decision making on local resourcing.

The GeoConnect³d project is developing a multi-scale structural framework in which geological maps and 3D models can be inserted and related to. In our novel approach, the structural framework reorganises geological information in terms of geological *limits* and geological *units*. Limits are defined as broadly planar structures that separate a given geological unit from its neighbouring units, e.g. faults (limits) that define a graben (unit), or an unconformity (limit) that defines a basin (unit). Geomanifestation data are then added to the structural framework model aiming to show where and how processes and structures may be linked.

This approach was tested in Belgium, where a structural framework was created at different scales, from most detail at 1:250,000 to more generalised at 1:2,000,000. Mineral occurrence data from the Minerals4EU database were used to test the model. As an example, a spatial link between Pb-Zn deposits and structural framework elements is identifiable in the Herve-Vesdre and Landenne areas. Although the deposits are located within the Variscan orogenic front, deposition is post-Variscan and spatially associated with transverse NNW-SSE faults part of the Rhine graben network (Dejonghe, 1998). With a combination of database attributes and SKOS vocabulary, the information of deposition age and time of activity of faults displayed in the structural framework helps to quickly place these deposits in the context of the Lower Rhine embayment. Therefore, the structural framework can translate highly technical scientific knowledge by using an interactive tool that presents information in a more understandable way.

We consider the outcomes of this test promising to fulfil one of the main goals of GeoConnect³d: preparing and disclosing geological information in a way it is more useful for stakeholders. We also consider this as the way forward towards pan-European integration and harmonisation of geological information, where the ultimate challenge is to correlate or otherwise link information from different geological domains and of different scales. This will be beneficial for the identification and better geological understanding of European mineral resources.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166.

Reference: Dejonghe, L., 1998. Zinc-lead deposits in Belgium. Ore Geology Reviews 12, 329-354.