Carbonate mineralisation in the supergiant Olympic Dam deposit

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The supergiant polymetallic Olympic Dam (OD) deposit is characteristically enriched in carbonate minerals. The relationships between carbonates and other minerals (hematite, magnetite, pyrite, Fe-Cu sulfides, uranium minerals), as well as the source of carbon remain unresolved.

OD is a breccia complex within the Mesoproterozoic granite that was intruded by ultramafic and mafic dykes. The ore minerals are associated with gangue minerals such as barite, fluorite, quartz, apatite and carbonates. Carbonate minerals occur in the association with the sulfides (particularly chalcopyrite) and gangue minerals.

Carbonates in the deposit increase in concentration towards the edges and at depth. REE-fluorocarbonates (e.g. bastnäsite-(Ce), synchysite-(Ce)) postdate the most common Ca-Mg-Fe-Mn carbonate minerals (siderite, calcite, dolomite-ankerite ss).

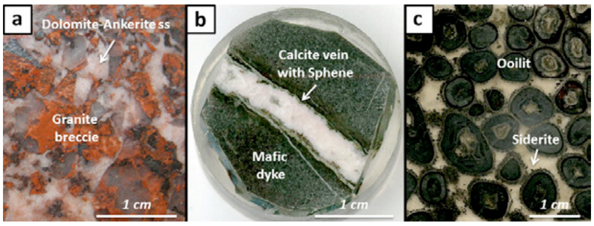

Figure 1: Some examples of carbonate textures.

In most cases carbonates appear as veins in different lithologies (mafic dykes, granite, mineralised breccia, figs. 1a,b) and rarely as oolitic rocks (fig. 1c). In addition, many carbonates occur in brecciated rock both as clasts and breccia cement (fig. 1a), providing evidence for numerous fauling and breccia-forming events. Various textures of carbonate-bearing rocks imply carbonate deposition in several stages.

The relative age of different carbonate generations based on dating of associated minerals (apatite, titanite, rutile, monazite) and $\delta^{13}C$ and $\delta^{18}O$ isotope signatures will be presented at the conference.

Reconstruction of redox conditions during deposition of Jordan oil shale using inorganic geochemical records

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With the global rise in petroleum demand the pressure on finding conventional hydrocarbon resources has increased substantially and has led to a shift in focus from conventional to unconventional resources. The situation is particularly precarious for Jordan as it imports ~97% of its current energy needs, which underlines the importance of finding alternative energy resources within Jordan and explains the increased focus on the huge reserves of oil shale in the country which exceed 65 billion tons [1]. Oil shales are characterized as thermally immature packages of fine-grained organic-rich sediments that require artificial heating to generate hydrocarbons [2].

Here we present an inorganic geochemical study of thick sections of oil shale from two neighbouring core-holes in Central Jordan. Bulk geochemical records (total sulphur, total carbon and total organic carbon) along with inorganic geochemical proxies (Fe sequential extraction and trace metals) are used to reconstruct the paleodepositional environment of the oil shale, with special emphasis on understanding the mechanisms behind high-frequency and high-amplitude variations in TOC content that characterize these deposits. The proxy records show that TOC and S_{total} vary in phase but exhibit high amplitude variability, while carbonates contribute the largest fraction to the sediments. Trace metal and Fe speciation data indicate that the depositional environment fluctuated between anoxic and euxinic conditions. The strongest enrichment in redox sensitive trace metals (e.g. Mo and V) and TOC occur in euxinic sediments. The subtle fluctuations in oxygen deficiency at the reducing end of the redox scale are believed to exert an important control on organic matter enrichment and quality.

[1] Alali, J. (2006). International Conference on Oils Shale: "Recent Trends in Oil Shale", Amman, Jordan. Paper no. Rtos-A1. [2] Dyni, J. R (2003). *Oil Shale*. **20**, 193–252.

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