Understanding Minerals Deposits and Ore Forming Processes - The Self-Organisation Concept and its Importance to the Search for New Mineral Resources

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Mineral deposits and ores bodies in the Earth's crust often are showing rhythmic patters as banded formations, layered and folded structures, diapirs or cockade ores. They range in size from less than centimetres up to kilometres.

It is suggested to apply the concept of Self-Organisation to mineral deposits research, see Jacob, Krug, Dietrich [1]. Considering mineral deposits and ore bodies as ordered structures allows us to recognise the spatial and time dependent distribution of its components as well as its properties. If they are influenced by external controls, such as energy or material supply, the interaction of components and properties differs, and hence is leading to different appearance of the structures. The order parameters, macroscopic descriptors like patterns, typically show dynamics of lower dimension than the control parameters. Hence, diversity and complexity to be examined are reduced and easier to understand.

Figure 1: Radiolarian cherts, Ras al Hadd, Oman

To prove the concept, we studied a recent early-diagenetic banded iron-manganese mud in an abandoned underground mine. For a period of 2 years. The results show, that the precipitated material undergoes internal self-organisation due to redox, colloid chemical, microbial, electrical and ripening processes. The primary banding, controlled by external fluctuations in precipitation, turned into the finally observed bands by non-linear coupling of reaction and transport processes within the mud. A genetic model for the banded mineralisation was developed and successfully verified by numerical simulation, Dietrich and Jacob [2] and [3].

[1] Jacob, Krug and Dietrich (1992) Erzmetall **45**(10), 505-513. [2] Dietrich and Jacob (1996) Geol Rundsch **85**, 29-37. [3] Jacob and Dietrich (1998) Natural Resources and Development **47**: 56-70