Geomicrobiology of ancient polymetallic Kupferschiefer black shale - minireview

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The highly mineralized upper Permian Kupferschiefer black shale located in the Fore-Sudetic Monocline (SW Poland) is a polymetallic, organic-rich sedimentary rock. It belongs to one of the largest copper and silver deposits in the world but it contains also large amounts of precious and rare elements such as nickel and platinum.

Indigenous microorganisms occurring in the black shale play a role in the biotransformation of the rock. The significant impact of heterotrophic bacteria represented by *Pseudomonas* sp. *Acinetobacter* sp. *Bacillus* sp. and *Microbacterium* sp. [1] includes such activity as: (i) degradation of sedimentary organic matter and metalloorganic compounds [2], (ii) bioweathering of rock-forming and ore minerals [3, 4], (iii) complexation of elements by bacterial extracellular metabolites such as siderophores and organic acids. All these activities strongly influence redistribution of carbon and other elements in the rock and are of environmental significance of the global biogeochemical cycle of elements in deep underground environment.

[1] Matlakowska & Skłodowska (2009) *J Appl Microbiol* **107**, 858-866. [2] Matlakowska & Skłodowska (2011) *Chemosphere* **83**, 1255-1261. [3] Matlakowska *et al.* (2012)*FEMS Microbiol Ecol* **81**, 99-110. [4] Matlakowska *et al.* (2010) *Environ Sci Technol* **44**, 2433-2440.

Chemical composition of chromian spinel of Podiform chromitite, Sangun Zone, southwest Japan.

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There are many chromitite pods in the Sangun zone belongs to inner zone of Southwest Japan. Most many chromitite pods enclosed by dunite rich ultramafic portion were discovered and outputted in this Zone, in Japan. Maximum size of chromitite-pod called "Nanago-ore body" which is 40*210*25m ($2.1*10^5m^3$) in size from Wakamatsu chromite mine of the Tari-Misaka ultramafic complex. In this study, I summarized the relationships between chromian spinel in chemistry and size of chromitite-pods for its origin which controls a size.

Chromitite-pods are divided into two groups by Cr# (Cr/(Cr+Al)) of chromian spinel from chromitite that are relatively high-Cr# (Cr#: 0.55<) group and low-Cr# (Cr#: 0.47-0.55) group. High-Cr# groups are from "Nanago-ore body" and "10th ore body" of Wakamatsu mine from Tari-Misaka ultramafic complex and chromitite pods from Takase and Ashidachi ultramafic complexes. Low-Cr# groups are from 51st, 52nd, 53rd, 54th, 55th, and 56th ore bodys of Wakamatsu mine from Tari-Misaka ultramafic complex and chromitite-pods from Inazumiyama, Mochimaru, Yagami, Ashidachi, and Yanomine ultramafic complexes.

Cr# of chromian spinel in dunite-harzburgite host rock of chromitite varies from 0.45 to 0.65 in "Nanago-ore body" and "10th ore body" of Wakamatsu mine and 0.40 to 0.60 in the other chromititite-pods.

Relationships Cr# of chromian spinel from chromitite-pods and from dunite-harzburgite indicated that it was a relatively large-scale chromitite which shows high Cr# of chromian spinel in this area. The results of above characteristics clearly show that spinel precipitation and concentration are more intense at "Nanago-ore body" than at the other chromitite bodies of the Wakamatsu mine and the other chromitite-pods of other ultramafic complexes. That is supposing the origin of chromitite is the magma mixing which continues with melt and the reaction of a wall rock ultramafic rocks [1], the reaction ratio and reaction stage are important. Matsumoto *et al*., (2002) [2] also pointed out this importance by resarch of Wakamatsu chromitie mine. This study support the idea.

[1] Arai and Yurimoto (1994): *Econ. Geol*., 89, 1279-1288. [2] Matsumoto *et al.* (2002): *Shigen-Chishitsu*, 52, 135-146.

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