

## The Geochemistry and AMD Rate of Parvade Coal Mine, Tabas, Iran

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The Tabas Parvade Coal Mine is located in Yazd Province, 80 km south of Tabas. For years this mine has been active and has been provided the most shares of coke for iron melting factories in Iran and has been exported abroad.

The exploited coal layers are situated in Ghadir Member, in Naiband Formation (Upper Triassic). Five coal layers: B1, B2, C1, C2 and D have investigated. B1, B2, and C1 are the exploitable layers. The Tabas Coal is believed to be of an excellent quality. However it is grouped as a high ash with medium to high sulfur content. Sulfure is originated from syngenetic pyrite. The coal is rich in TFeO, V, Ni, Co, Cr, and V, while the gaung is rich in SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Sr and Zr. The concentration of Ce, Y, Cu, Ni, Co, Cr and V are more than clarke, whereas Zn, Rb, and Sr are lower than their clarkes. The average amount of elements in Parvade coal is much more than the mean of the world. Based on the principle component analysis C1 (1<sup>st</sup> component) is related to the concentration of major oxides such as MnO, MgO and CaO (44.12% of the total Variance), related to epigenetic calcite and dolomite. C2 (2<sup>nd</sup> component) is related to Al<sub>2</sub>O<sub>3</sub> and SiO<sub>2</sub> (22.83% of the total variance), related to detrital quartz and clay minerals. C3 (3<sup>rd</sup> component) is related to K<sub>2</sub>O, TiO<sub>2</sub> and Na<sub>2</sub>O (18.02% of the total variance) and is related to illite and anataz among coal layers. The sediments adjacent to the mine show contamination to Cd, Zn, Cu, Fe and As. But no sign of Pb and Sb contamination has been found. The water samples, collected from the mine area show contamination to Fe, Pb, Cd, As and Sb. But there is no sign of Cu and Zn contamination. The water in the area is mainly of Na-Cl type, polluted and is not suitable to be considered as imbibing water.

## Simultaneous analysis of microbial identity and function using NanoSIMS: Application to anaerobic degradation of methanol

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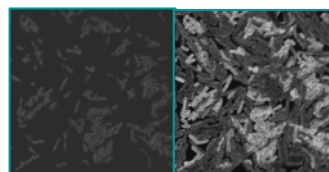
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### Methodological Development

Identifying the function of uncultured microbes in their environments remains one of the main challenges for microbial ecologists. We developed a method based on the visualization of iodized oligonucleotide probe-conferred hybridization signal and isotopic measurement using NanoSIMS [1]. Feasibility tests on pure bacterial strains show that this technique allows the simultaneous analysis of microbial identity and function as illustrate on figure 1.

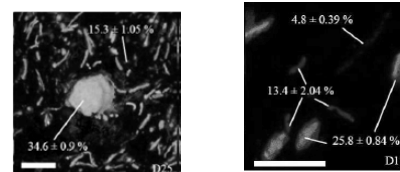


**Figure 1:** Nanosims image of a mixture of *E. coli* and *Bacillus subtilis* respectively enriched in <sup>13</sup>C at 40% and 10%. Only *E. coli* was hybridized with the iodized probe A: <sup>13</sup>C abundance; B: Iodine abundance.

### Application to Methanol Anaerobic Degradation

During <sup>13</sup>C enriched methanol incubations in anaerobic condition the isotopic enrichment of the different degradation products (carbonate, acetate...) has been determined. It was then possible to identify the metabolic pathways responsible for the degradation of methanol.

Involved microorganisms have been identified using SIP methodology and Nanosims as illustrated on figure 2.



**Figure 2:** <sup>13</sup>C abundance in samples coming from a <sup>13</sup>C methanol anaerobic incubation after 17(A) and 25 (B) days.

[1] Li *et al.* (2007) *Environmental microbiology* **10** (3), 580-588.