

8th INTERNATIONAL SYMPOSIUM OF SUBSURFACE MICROBIOLOGY ISSM 2011
SEPTEMBER 11–16, 2011, GARMISCH-PARTENKIRCHEN, GERMANY

The conference on subsurface microbiology in Garmisch-Partenkirchen attracted 250 scientists from 25 countries. This time the conference offered 15 different scientific sessions and for the first time in the history of the ISSM meetings, scientists studying karst and cave microbiology got their own session. Annette Summers Engel was the invited lecturer. With the respect to other subterranean habitats where one of the invasive techniques has to be used to reach the site of interest, such as drilling or digging, only the caves offer “non-invasive” insight into processes because they are natural windows into the underground.

The red line of all talks and discussions were not only who is down there “below our feet” in the subsurface, but what do they do, and how much of what. Nevertheless, when a new environment has been discovered the most important question remains: who is there? Such an example is extreme seafloor drilling and establishing of artificial hydrothermal vents for scientific investigation. And search for habitability and physical boundary between biosphere and abiosphere was again moved downwards. So, how deep is there still life?

Life in tiny little fractures in rocks is very dynamic in spatial and temporal aspects. Paleometeoric waters are virtual time capsules for deep life. In such systems new phylogenetic lineages were discovered, but not just microorganisms, but also higher organisms, such as worms. Lipid molecules are considered geomolecules in helping to reconstruct the origin of various sediments. Interestingly, lactate was found to be a favourite substrate for growth for microorganisms from deep biosphere, and it seems that there is no relation between depth in the biosphere and microbial number. Many independent studies showed that the cell density in the deep biosphere ranges between 10^3 and 10^6 cells per millilitre. Certainly, bacterial viruses have an important role in such environments: in such systems a ratio between phages and bacteria is twelve to one. Besides viruses, heterotrophic flagellates seem to play also an important role in the underground systems.

The present knowledge on microbial metabolism is not yet all. New potential metabolic pathways are on

the horizon, for example denitrification coupled with oxygen production, or electron shuttling over long distances, millimetres to centimetres mediated by humid acids. How and to what extent cross-feeding does occur in an isolated subsurface ecosystem is an important question for understanding kinetics in the biosphere. Deep biosphere represents between 56–300 Pg of carbon in contrast to 1000 Pg of total global carbon. But on the other hand available energy reflects in the diversity of sites. Study of metabolism at extreme conditions enabled development of novel techniques or improving existing ones, such as microcalorimetry. Microcalorimetry became a popular technique to observe the potential of biomass activity via heat production. One bacterial cell produces on average between 2–5 pW of energy.

One important exploitation driver of the subsurface environments is oil. Underground contains important oil reserves of which some are already biodegraded. Oil composition closer to an aquifer is changed. Oil remained more or less intact when it “passed” the paleopasteurization process. Marginal conditions seem to be: salinity above 100 g/l, and temperatures above 80°C. At such conditions life becomes energetically very expensive, for example methanogenesis at such conditions simply does not go. For biodegradation is important overlapping of zone of electron donors and electron acceptors.

Several talks and posters addressed a very important issue – bioremediation of polluted areas. Major waste at communal landfills is paper and landfills are completely understudied environments. Microbial mediated remediation processes were successfully adopted in some sites contaminated with strontium and uranium after mining ceased. Some contaminants travel underground slowly, but perhaps in 20 years they can reach an aquifer for water consumption.

The new president of the society became Kenji Kato and the next ISSM meeting will be in 2014 in San Francisco, USA.

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