

ISSM 2008

7th International Symposium for Subsurface Microbiology
November 16-21, 2008, Shizuoka, Japan

From the first naive recognition in the early 1980's of microbial life in the subsurface, subsurface microbiology in recent years is no longer important only in academic debates, but is becoming more relevant to societal issues, such as the construction of safe nuclear waste sites.

The 7th International Symposium for Subsurface Microbiology (ISSM) in Shizuoka, Japan, offered eleven lecture and three poster sessions for 230 participants from 22 countries. Topics presented spanned the range of microbial interactions in subsurface habitats (deep igneous aquifers, mines, caves, submarine hydrothermal vent systems, soils, and water bodies), the evolution of geochemical and microbiological systems through time, life in extreme environments, the application of metagenomics, and issues and technologies concerning bioremediation and even the safety of "microbially resistant" radioactive waste disposal sites.

Several recurring themes focused on trying to answer key questions, including where does the biosphere end and the geosphere start, and how can we apply our technological advances from the shallow subsurface settings, like soils and caves, to explore the deeper, hotter biosphere, including from submarine settings?

The emergence of life on Earth and other planetary bodies is a topic that attracts broader audiences, and the participants also explored and debated various evolutionary possibilities. For instance, the minimum temperature for modern metabolic processes is about -20°C. But, if we take into account that the average temperature in the universe is -270.5 °C, is it possible that life can exist at lower temperatures or that life evolved at lower temperatures? Life survival strategies were also discussed, including how microbes deal with environmental stress like high oxygen concentrations and desiccation.

One common topic for discussion was that there are many emerging, new techniques to study the interactions between subsurface microbes and their environments, including technologies that enable the identification of biosignature molecules and new genes that can confer metabolic capacity under various conditions and even stress responses. These discoveries lead to the description of new organisms, but also an understanding of evolution due to the frequency of horizontal gene transfer from one microbial species to another.

In the past, microbiology was not significantly justified in the context of environmental intervention. However, nowadays as many places are becoming in-

creasingly contaminated with heavy metals, chlorinated compounds, and other pollutants, there is a need to understand successful bioremediation processes, and cometabolic and intermicrobial reactions. For example, research that was presented on this topic described how microbes can immobilize uranium compounds or accumulate toxic arsenic molecules, and how cyanobacteria can remediate polluted areas.

The interest in subsurface microbiology to waste disposal has resulted in a number of studies that have been conducted by research groups from multiple countries. Their results reveal relatively high numbers of microbial taxa from various rocks that are capable of living in biofilms that depend on a flux of energetically favourable compounds in water, and sometimes even from surface-derived organic matter. As a consequence of their metabolism, the indigenous microbiota can corrode concrete or metal shields around nuclear wastes.

The participants in the symposium did not avoid very urgent issues, such as climate change. Although responses to climate change can be observed in higher animals and plants, recent research indicates that microbial communities are also affected. For instance, experiments show that microbes metabolize more polymers preferentially at lower temperature, but they use more carboxylic acids at higher temperatures. Other issues, such as how to deal with greenhouse gases, were also presented, including the introduction of CO₂ into the underground.

Because caves in karst are natural windows to the underground, the topic of caves was brought up on several occasions by speakers, in posters, and from plenary lectures. More microbiologists who study caves and karst were encouraged to participate in future symposia.

The next ISSM conference will be held in Munich, Germany, in 2011.

Janez Mulec