

# Nano, bio and planetary sciences: the 19<sup>th</sup> meeting of the International Mineralogical Association

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The Convention Center of Kobe (Japan) was the host institution of the 19<sup>th</sup> General Meeting of the International Mineralogical Association (IMA) between 23<sup>rd</sup> and 28<sup>th</sup> of July 2006 (Fig. 1). The Kobe Congress was organized by *The Science Council of Japan*, *The Mineralogical Society of Japan* (MSJ), *The Japanese Association of Mineralogists, Petrologists and Economic Geologists* (JAMPEG) and *The Japanese Society of Resource Geology* (SRG). Dr. Takamitsu Yamanaka from Osaka University (Japan) was the chairman of the congress and K. Fujino from Hokkaido University was the secretary general.



Fig. 1. View of the Kobe Convention Center.

IMA is the oldest international scientific organization of mineral sciences. It promotes mineralogy and plays a vital role in science, regarding mineralogy as influencing the human welfare, the metalliferous and non-metalliferous mining, the exploitation of petroleum and industrial minerals, the waste disposal, the pollution remediation, and the soil science. Mineral surfaces stand at the interface between the atmosphere, the biosphere, and geosphere and, consequently, they represent keys to understand the past, the actual and future global change. Mineralogy is fundamental to understand the chemistry, the genesis and age of rocks. These include the extraterrestrial materials, which give us clues about the origin of the Solar System and the possibility of life on other planets. Experimental mineralogy, strongly connected with materials science, allows us to deduce the nature of the deep and inaccessible parts of the Earth. The title of the congress: *Expansion to Nano, Bio, and Planetary Worlds* took the new trends into account in bridging mineralogy to technology, live sciences and planetary sciences.

The meetings of the IMA are quadrennial world conferences. The president of IMA between the 18<sup>th</sup> and 19<sup>th</sup> meetings was Ian Parson from the Edinburgh University, U.K. The 19<sup>th</sup> meeting which was held in Kobe this summer had almost 1000 registered participants coming from 50 countries. During the six days of the conference, 874 contributions - 488 oral contributions and 386 posters - were presented by scientists in the field of mineralogy, material sciences, geochemistry including biogeochemistry, petrology, economic geology and related sciences. Many sessions were devoted to the application of mineralogical sciences to planetary science, bioscience and material sciences. Additionally, six field excursions were held before and after the conference. The contributions were published in the Program & Abstracts Volume (350 pp).

The contributions were organized into 37 scientific sessions. Only a small selection of topics can be presented here, such as *Phase transitions and thermodynamic modeling of minerals and rocks*, *Physical properties of minerals and rocks at high pressures*, *New applications of spectroscopy in mineral sciences*, to *Crystal structure, topology and crystal chemistry*, *Nucleation and Aggregation of macro- to nano-materials* and *Bio-Geo interface in minerals*. Petrological sessions included among others: *Sea-floor hydrothermal systems: Present and Past examples*, *Metamorphism under extreme P-T conditions*, *Subduction factory and continental evolutions* or *Oceanic crust and mantle processes*. Each scientific session had a number of keynote speakers presenting outstanding results and overviews. The scientific standard of the talks was very high, reflecting the emphasis placed by universities and research institutes on mineralogy and materials science.

A short review of the contributions can highlight only partly and arbitrarily the main scientific achievements since the total number of oral presentations and posters were close to 1000. Only a very limited number could be attended. Nine plenary lectures gave an overview on the present state of research in some hot scientific topics.

For example the lecture by J. Banfield et al. from University of California, USA, entitled *Microbial metabolism and the size-and chemical environment dependence of the structure and reactivity of nanoparticle products* presented new discoveries on the formation size, structure and crystal growth kinetics of nanoparticles. Adsorption of ions to surfaces can induce an internal ordering which can become irreversibly. Biologically generated ZnS nanoparticles showed an isotopic fractionation, which could be attributed to fluctuations in

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metabolic rate. The presence of adsorbed proteins plays a role in aggregate formation.

L. Keller and S. Messenger (NASA, USA) with their contribution: *The nature of early solar system and presolar materials* marked another actual trend in mineralogical sciences. Transmission Electron Microscopy (TEM) provides mineralogical, crystallographic and chemical data on interplanetary dust particles. According to the small size (below 1  $\mu\text{m}$ ) they were detected only recently. The dust particles contain silica grains which are assumed to have an extrasolar origin because their anomalous isotopic composition. These studies will drastically improve the knowledge about the conditions and history of the dust as outflow of evolved stars, the accretion in the presolar molecular cloud and the interaction with materials formed in the early solar nebula.

Lukas B. Baumgartner et al. presented an important lecture: *Mineral growth in high and low pressure metamorphic rocks*. In regional metamorphic and contact metamorphic areas minerals such as garnet form typically in a solid matrix. They are often used in determination of pressure and temperature of metamorphism. New studies of REE geochemistry allow inferences on the age and duration of garnet growth. This investigation indicates significant disequilibrium in the minerals, in particular in fluid-rich environments. Mineral growth and nucleation are important factors to better understand metamorphism. In time, it will lead to calibrate tectonic models better, rather than by using equilibrium thermodynamics.

Another important highlight was the lecture *Operation of subduction factory and production of andesite* by J.Y. Tatsumi and T. Takahashi. In their view, subduction is compared with factory processes, which consume materials such as oceanic sediments and basaltic crust and produce solidified materials and continental crust (Fig. 2). Modified oceanic or mafic lower crust is waste materials, common in all factories. They are transported into the mantle and finally recycled as mantle plumes. Andesite, one of the products of the factory, composes the bulk continental crust and can be derived from calc-alkaline and tholeiite series. Tholeiitic magmas are most likely produced by anatexis of pre-existing mafic lower crust, on the other hand calc-alkaline magmas are seen as products of mixing of mantle-derived basaltic magma and crustal-derived felsic tholeiites.

S. Iijima bridged mineralogy and technology looking into nanomaterial with his lecture *Nanomaterial research learning from mineralogy*. Using HRTEM the author discovered a number of nanomaterials. Only 15 years ago, carbon nanotubes were found. They are tube-like structures composed exclusively of carbon. HRTEM allows the structural characterization of the nanotubes and even to visualize atomic defects. They have a wide field of application, in particular in biotechnology.

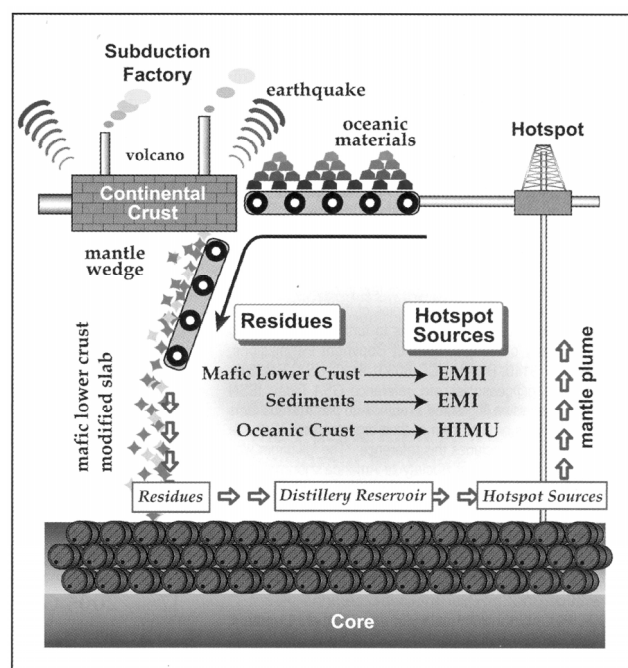


Fig. 2. The principles of the subduction factory according to Tatsumi (2005).

During the congress, the IMA commissions had several meetings: Commission on new minerals and mineral names, Commission on ore mineralogy, Commission on applied mineralogy, Commission on mineral growth and interface processes, Commission on gem materials, Commission on museums, Commission on physics of minerals, Working group on environmental mineralogy and the Working group on inclusions in minerals.

The Council of IMA is presently lead by Takamitsu Yamanaka (Japan) as President, Maryse Ohnenstetter (France) as Secretary, Frances Wall (UK) as Communication Officer and Robert Downs (USA) as Treasurer. An annual IMA Medal for Excellence has been founded. Candidates have to be nominated by national societies and by individuals.

The next world mineralogical conference, the 20<sup>th</sup> IMA meeting, will be held in Budapest in August 2010, jointly organized by Austria, Hungary, Romania and Slovakia ([http://www.univie.ac.at/Mineralogie/IMA\\_2010/](http://www.univie.ac.at/Mineralogie/IMA_2010/)).

## REFERENCES

- Tatsumi, Y. (2005) The subduction factory: How it operates in the evolving Earth. *GSA Today*, 15 (7): 4-10.
- \*\*\* Program and Abstracts of the 19<sup>th</sup> General meeting of the International Mineralogical Association, Expansion to Nano, Bio and Planetary Materials, Kobe, July 23-28 2006, 350 pp.