# NOTES

## GENERATION AND EMPLACEMENT OF OPHIOLITES THROUGH TIME

An International symposium on "Generation and Emplacement of ophiolites through time" was jointly organized by the Geological Survey of Finland and the University of Oulu at Oulu, Finland from 10-15th August, 1998. Seventy delegates from 20 countries were invited to participate in the symposium. The broad objective of this meeting was to bring together international expertise on ophiolitic rocks generated at different stages of earth's evolution. The ophiolites discussed in the symposium ranged in age from 3.48 Ga Jamestown ophiolites (Barberton Mountain Land, South Africa) to the 5.5 Ma Taiota ophiolites (Chile). Thirty four papers were presented in 9 sessions and fifteen papers were presented as posters. A field excursion was organized for 3 days after the symposium.

The symposium started with a thematic paper by E.M. Moores on ophiolites, orogeny and earth's history in which the ophiolitic sequences formed at different tectonic settings, their stratigraphy, structure and geochemistry were discussed. Different types of ophiolites formed at different tectonic settings and the impact of mantle chemistry on these were related with the subtle changes of the earth's evolutionary processes. Moores argued that around 1.0 Ga ago the decline in thickness of oceanic crust would have first led to major continental emergence in the Earth's history and widespread increase in atmospheric oxygen. Brian Strurt emphasized on the tectonostratigraphic significance of ophiolites of the Scandinavian Caledonides. Alexander Efimov explained the scheme of generation of modern oceanic and ancient oceanic (ophiolitic) lithosphere with melting model of the axial magma chamber beneath the EPR 9°30'N and P, T conditions of spreading ridges. Don Elthon presented the petrology and geochemistry of the world's youngest Taiota ophiolites of Chile (<4 m.y.) exposed along the Pacific coast of Chile (46°S), within 15 km of Chile rise, where MOR spreading centre enters the Chile trench. He proposed two alternative models for their origin. One as fore-arc rift formed above the subducting spreading centre and the other one as a ridge prior to obduction and emplacement of Chilean margin. Bebien Jean presented magmatic and metamorphic processes associated with the initiation of subduction near the ridge for the formation of Albanian ophiolites and explained them through the help of $Ar^{40}/Ar^{39}$ data and P, T determination on granulite and greenschist facies rocks. He related them to an infant subduction in which magmatism showing a MORB affinity closely resemble with island arc type magmatism during pre-stage and consequently provide a significant opportunity for the investigation of suprasubduction zone ophiolites. On the basis of palaeomagnetic rotation on global scale, the internal rotation of the belt and the shallow level (2 km) focal point of strong earthquakes, Adolphe Nicolas presented an interesting paper on EPR microplates forming superfast subducting conditions for the formation of Oman ophiolites. In the light of recent analytical and experimental data, Don Elthon explained the petrological complexities and different enigmatic features of ophiolites. On the basis of the field relationships and geochemical features he proposed a composite origin for most of the ophiolites that are often associated with super subduction zone terrains. With the help of $\varepsilon_{Nd}$, REE, zircon ages and carbon isotopic data Eero Hanski demostrated the presence of 2.0 Ga old oceanic crust in the Kittila greenstone belt of Northern Finland and regarded it as an allochthonous unit born in an oceanic environment and then obducted on to an Archaean basement. From the Palaeoproterozoic greenstone belt Hanski produced evidence for the juxtaposed coexistence of MORB, IAT and OIB type magmas and proposed that the features of this belt make it a unique stratigraphic unit, unparalleled in the standard Palaeoproterozoic stratigraphy of Fennoscandian shield.

From the Indian subcontinent 3 abstracts were submitted. One on the ophiolites of Andaman-Nicobar, other one on the oceanic crust of Sandur schist belt and the third one on Waziristan Mulsimbagh ophiolites of Himalaya. The Sandur metavolcanics geochemistry was presented by Manikyamba. She argued that under higher geothermal regime with faster Wilson Cycle operating on smaller plates, entire ophiolitic sequence is rarely preserved in Archaean. Further, Archaean basalts and komatiites were generated at shallow fertile mantle and could not be differentiated from plume magmas. The Baluchistan work could not be presented. The harzburgite type of ophiolite of this region occupies 800 $km^2$ and is represented by 17.5 km thick slab of oceanic lithosphere forming a complete and continuous sequence from ultramafic tectonic to sheeted dyke complex. This complex appears to have formed 81 Ma ago and tectonically emplaced onto the NW margin of Indian plate during 71-65 Ma. The late Cretaceous intraoceanic plate alkaline volcanism represent the mantle plume activity of Reunion hotspot.

The 3.48 Ga old Jamestown ophiolitic type sequence of Barberton Mountain Land, South Africa (de Wit) and the late Archaean ophiolites of Baltic shield (Slabunova) and the economic deposits of ophiolites like Cu, Au, soapstone, and PGE were discussed during the symposium. In addition there were several interesting poster sessions on Precambrian ophiolites, Mesozoic boninitic tonalites and trondhjemites, and ophiolitic melange zones of China etc.

The Symposium was followed by three day field excursion. 1st day visit was to Jormua ophiolite complex (JOC) of Palaeoproterozoic age. Mantle peridotites, various sheeted dykes, cumulate dykes, gabbroic rocks, plagiogranites, pillow lavas and podiform chromitite are some of the important rock types exposed and examined in Jormua ophiolitic complex. It was an excellent opportunity to observe the entire 1.95 Ga ophiolitic complex, which is one of the presently known well documented Palaeoproterozoic ophiolites that comply with the widely accepted Penrose conference ophiolite definition. The Purtuniq ophiolites of northern Qubec (1.992 Ga) is considered (paper presented during the meeting) to represent a mature open ocean, whereas Jarmua ophiolite complex (JOC) is believed to have been formed in an incipient ocean setting. The presence of very refractory peridotite represents residual mantle material in JOC makes it unique among the other known Palaeoproterozoic ophiolites. The 2nd day excursion trip was to Archaean greenstone complex at Kuhmo greenstone belt in which ultramafic complex, pyroxenite dykes, Archaean komatiite lava river, spinifex texture in komatiites, pillow lavas and BIFs were observed. This belt is a type section of Archaean supracrustal sequence. It contains a 6 m thick pyroxene spinifex-textured komatiitic basalt layer in addition to ultramafic komatiites. The area is believed to represent an Archaean komatiite lava river. Third day excursion was to observe the important economic minerals in ophiolite at Outokumpu region to see the soapstone quarry, talc mines, chromite and the copper-cobalt sulphide ores. The excursion guide book was an excellent production with colour maps and photographs, petrological and geochemical data for all the stops covered during three days. Since the number of participants was not very large and people directly interested were involved, in-depth discussion took place between participants and provided for a full and fruitful discussion.

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