ROOM 03 – GONDWANA BREAK UP (GBREK-03)

SESSION 1 – TECTONIC, MAGMATIC, SEDIMENTARY AND THERMAL EVOLUTION OF RIFT SYSTEMS IN CONTINENTS AND BACK ARC SYSTEMS LEADING TO FORMATION OF OCEANS

Conveners: Gianreto Manatschal (France), Luciano Magnavita (Brazil), Natasha Stanton (Brazil) and Maryline Moulin (Portugal)

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Rifting is a significant process in Earth history leading to the formation of continental rifts, back arc basins and oceans, as in the case of the Gondwana continent in the Mesozoic. New observations from fossil and present-day rifted margins show that the evolution of rift systems as well as the processes related to rifting are much more complex as previously suggested by simple models. We propose a session that includes general presentations of rift systems with particular interest on contributions addressing the influence, evolution and interaction of various rifting processes such as deformation modes, sedimentary processes, serpentinisation, magmatism, and hydrothermal processes. Of particular importance will be the evolution of rift magmas. Magma starvation and/or excess during rifting may tell us about composition and thermal structure of the mantle and the temporal and spatial distribution of the magmatic systems within the rift. It also may explain the geometry and dynamics of mantle upwelling, as well as importance of inherited structures such as pre-existing arcs or suture zones that trap and localize the nascent divergent plate boundary. Topics that we also hope to address include: What is the role of rift obliquity? What governs the initial magmatic and tectonic segmentation of the rift? How do the separation of ancient lithospheric mantle and the upwelling of asthenosphere occur? Can/do fragments of ancient lithosphere become “trapped” in the asthenosphere beneath the spreading rift? What are the role and mechanisms of strain localization in rifted orogenic lithosphere?

We invite contributions to a session that will allow exchange of views between academia and industry in the different tectonic settings mentioned in the title, as well as across disciplines, especially geophysical and structural observations, petrology/geochemistry, sedimentology and numerical modelling. We hope that the session will foster discussions concerning the whole range of mechanisms associated with lithospheric extension, ranging from little extended intracontinental rift basins to mature rifted margins where break-up and plate separation will eventually occurred.

SESSION 2 – MANTLE PLUMES AND GONDWANA BREAK UP

Conveners: Sérgio Valente (Brazil), Artur Corval (Brazil), Gillian R. Foulger (UK)

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Convection in Earth's mantle created by the dissipation of internal heat produces up-welling hot columns called mantle plumes and cold, sinking sheets. Numerical modeling suggests the presence of three types of mantle plumes. Regular mantle plumes originate from the core-mantle boundary (a depth of approximately 1,802 mi [2,900 km]) and may be stable for several hundred million years. Such plumes act as fixed reference frames for plate motion. A second type of plume, also originating from the core-mantle boundary, can be bent and move relative to the global circulation in the mantle. Several mantle plumes may also collide to form superplumes. Superplumes rising from the core-mantle boundary may produce additional, secondary plumes that develop above a 416 mi (670 km) boundary layer in Earth's mantle. Mantle plumes impinge on the base of Earth's lithosphere in all plate tectonic settings and result in surface uplift of up to 875 yd (800 m), lithospheric thinning, extensional stress fields, and a thermal anomaly centered on the plume. Heating the base of the lithosphere by mantle plumes may lead to partial melting and the formation of mafic magma. Magma may intrude into fractures formed from extension of Earth's upper, brittle crust above mantle plumes to form mafic dike swarms. Magma may also be extruded as lava flows on Earth's surface to form flood basalts over areas 621 mi (1,000 km) or more across. For example, the Paraná and Etendeka volcanics represent pre-breakup volcanism on the South American and African margins of the Tristan Plume and volcanics of the Deccan Traps in western India result from melting due to the Reunion Plume. It is important to note that mantle plumes constitute a driving force in the fragmentation and rifting apart of continents. For example, the separation of South America from Africa and Greater India from Australia and Antarctica during the break-up of the supercontinent Gondwanaland is interpreted as resulting from rifts linking areas above several mantle plumes. Mantle plume-related rifts are typified by triple junctions where rifts, normal faults and dikes define arms at approximately 120° to each other that intersect above the mantle plume. Frequently, continental breakup and formation of oceanic crust occurs along two of the rift arms, whereas the third arm may be less developed, and constitute a failed rift or aulacogen. For example, a plume-related triple junction occurs over the Afar Plume, above which the Red Sea and Golf of Aden Rifts (along which there is active seafloor spreading) and the eastern, Ethiopian branch of the East African Rift (an intra-continental rift system) intersect. Not all plume-related rifts, however, define triple junctions and four or more rift arms may sometimes be present. Nevertheless, the purpose of this symposium is to comprehend the role of the mantle plumes in the scenario of Gondwanaland's break up. Papers and studies involving the production, interpretation and integration of petrological, structural, stratigraphic, geochronological, geophysical and isotope data will be encouraged to be published at this session. All of these data should be useful to the elaboration of models that will contribute not only to the elucidation of complex mantelic and crustal process, but to the comprehension of the parameters which control the generation and distribution of mineral reserves as, for example, gas and oil in sedimentary basins located in areas of continental rifting. In addition, new geochemical, isotopic and geochronological data will certainly put constraints on robust geodynamic models for the West Gondwana in Early Cretaceous time.

SESSION 3 – GONDWANA OROGEN – PASSIVE MARGIN SYSTEMS

Conveners: J.Jacobs (Norway), R.Schmitt (Brazil) and R.Thomas (UK)

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Gondwana assembled along a network or orogens that show strongly contrasting styles, including large, hot, cold, narrow, extensive, etc. Gondwana break-up mostly followed these Brasiliano-Pan-African orogens, and the contrasting orogen styles governed the Gondwana break-up geometry, including orthogonal, oblique, pull-part, wide, narrow. Some orogens did not undergo reactivation and break-up. In this session we look into possible links of how the style of orogens influences the geometry of rifted margins. We seek contributions from field studies in Gondwana orogens and passive margins as well as contributions from geodynamic modeling.