Interpreting Himalayan orogeny via the Paleozoic Scandian analogue

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The Scandinavian Caledonides appear to comprise a particularly useful analogue for the Himalayas. Older, Himalayan-type orogens, deeply eroded to middle and lower crustal levels, provide opportunities for improving our understanding of the younger mountain belts and orogen dynamics. Collision of Baltica with Laurentia in the mid Paleozoic resulted in many hundreds of kilometers of underthrusting of the latter by the former. Hot allochthons, sourced in the underthrusting outer margin of Baltica were extruded laterally onto the Baltoscandian platform. These nappes can be traced 200 km across the orogen into the hinterland to the classical HP and UHP terrains of the western Scandes. Recent work (*in situ* U-Pb SIMS dating) on the Seve Nappes in western Jämtland, Sweden, has yielded zircon ages on granulite facies migmatites and leucogranites of 442 ± 2 Ma. Apparently, the hot allochthon, which was generated about 400 km further west in the hinterland of the orogen in the earliest Llandovery, was emplaced onto the Baltiscandian platform during the Llandovery and early Wenlock, in accord with the stratigraphical and sedimentological constraints in the overlying (Köli) and underlying (Jämtlandian) allochthons. Grt-Bt and Ti-in-Bt geothermometers and the GASP geobarometer were used to estimate the P-T conditions of Åreskutan migmatites in the Seve Nappe. The peak-T was estimated at c. 716°C for Grt-Bt pairs and somewhat higher at c. 735°C using the Ti-in-Bt method. The peak-P for the partial melting event was estimated at c. 5 kbar. These data confirm that the migmatites were formed under granulite facies conditions. Study of the Seve Nappes is also providing evidence of the provenance of the sedimentary rocks, the source area being dominated by Mesoproterozoic igneous and metamorphic complexes and ranging from Sveconorwegian (c. 900 Ma) to Svecofennian (c. 1700 Ma) in age. This evidence provides further support for the interpretation that the Caledonian hinterland in the Neoproterozoic was dominated by Grenvillian-Sveconorwegian terranes and that the Iapetus Ocean may well have opened along the axis of this older orogen.

Archaeal and bacterial diversity and distribution in methane seep of Yung-An Ridge, SW Taiwan

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A new cold (methane) seep environment was identifed in the Yung-An Ridge located in the Northeastern South China Sea continental margin off southwestern Taiwan. Archaeal and bacterial communities in cores obtained from deep marine sediments in the Yung-An Ridge were investigated. 16S rRNA gene and rRNA clone library and phylogentic analysis showed that Marine Benthic Group D, ANME, SAGMEG, DSAG and MCG phylotypes are dominant in archaeal community, and the Planctmycetes, Chloroflexi, JS1 division and Proteobacteria are dominant in bacterial community. Among them, the total clones of phylotypes Chloroflexi, Planctomycetes and JS1 are dominant in all study cores and over 96% for core-18 at the west side of Yung-An Ridge which represent the bacterial community structure of the methane hydrate bearing sediments [1].

The relation of microbial distribution with geobio-chemical cycling was analyzed. The distribution of sulfur reducing organisms as sulfur-reducing bacteria (SRB), sulfur-reducing archaea (SRA) and methane oxidizing archaea (ANME) in all study cores at various depths are well co-related with the level of sulfate and dissolved sulfide. Depths of the sulfate methane interface (SMI) of study cores shifted gradually from a depth of 103 cm at the east side to a depth of 403 cm at the ridge west. The anomalous high amount of methane (12,000-22,000 CH_4 μL/L) at study cores were detected at the depths where ANME, SRA and SRB also occurred, which often at the same depths of SMI, but not the depths that methane producing archaea existed. The unusual high concentrations of biogenic methane may originate at depth and migrate through the homoclinal Yuan-An Ridge [2] and contribute to the ANME based ecosystem.

[1] Inagaki (2006) *PNAS* **103**, 2815-2820. [2] Lin (2008) *Mar. Geo.* **255**, 186-203.