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The South Tibetan Detachment System: Thermal and mechanical transition from deeper to upper structural levels

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The South Tibetan Detachment System (STDS) is a primary tectonic feature of the Himalayan chain, cropping out for more than 2000 km along the belt. It separates the low-grade-metamorphic rocks of the Tibetan Sedimentary Sequence (TSS) in the hanging-wall, from the high-grade-metamorphic rocks of the High Himalayan Crystallines (HHC) in the footwall.

The architecture of the STDS is made up by a lower ductile shear zone affecting high –grade metamorphic rocks of the HHC and the lower portion of the TSS, deformed under amphibolite facies conditions (i.e. Checka Formation, Everest series, Haimanta Group). An upper low-angle normal fault divides the high-grade metamorphic rocks from the very-low-grade rocks of the TSS.

Several competing tectonic models, regarding the exhumation and extrusion of the high-grade metamorphic rocks of the HHC are nowadays objects of debates. In these models the STDS, joined with the partly coeval lower Main Central Thrust played a crucial role. The knowledge of the thermal and structural activity of the STDS can give a fundamental contribution to discriminate among the different proposed tectonic models.

By the way most of the structural and thermal studies focused on the kinematic and thermal profiles of the footwall rocks and only few studies have been concentrated on the hanging-wall rocks.

During this work we focused on two sections of the STDS cropping out east of the Ama Drime range (Dingyee area, Southern Tibet) and west of the Annapurna massif (Kaligandaki valley, Central Nepal). Here we concentrated on the hanging-wall rocks of the STDS represented by Ordovician limestone in the first transect and by impure marbles and quartzites in the second one.

Meso and microstructural studies have been accompanied by illite crystallinity analyses, calcite-dolomite geothermometer and stable isotope analyses on selected samples. Microfabric analysis of calcite shows shape and lattice preferred orientations as well as grain size reduction within layers of cm-thickness.

Moving upward in the sequences, primary sedimentary structures are still well recognizable and there is a transition to very-low grade deformation mechanism where pressure solution is predominant.

In both sections a downward increase of deformation temperatures have been detected highlighting an apparent abnormal geothermal gradients of $\sim$ 300°C/km and telescoping of the isotherms. Vorticity analyses point out a strong component of pure shear during STDS activity.

The discrete low angle fault has been recognized only in the Dyngee section and it cuts through mylonitized Ordovician limestones, testyfing a transition of the ductile shear zone from deeper up to higher structural levels.