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Sillimanite-bearing shear zones in the core of the Himalayan belt (Western Nepal): consequences on the exhumation of the Higher Himalayan Crystallines

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The Himalayan belt in Western Nepal is characterized by the occurrence of four main tectonic units that from the bottom to the top are represented by the Lesser Himalaya (LH), Lesser Himalayan Crystalline (LHC), the Higher Himalayan Crystalline (HHC) and the Tibetan Sedimentary Sequence (TSS).

The HHC is regarded as an extruding wedge of crystalline rocks bounded by the top-to-the SW Main Central Thrust, at the base, and by the top-to-the NE South Tibetan Detachment System at the top (Burchfiel et al., 1992; Hodges et al., 1992; Grasemann et al., 1999; Gruijc et al., 1996; 2002).

The HHC is usually regarded as a unitary high-grade crystalline unit with similar tectonic and metamorphic features all over the Himalayan belt (Le Fort, 1975). Most of researches have been concentrated on its upper and lower tectonic boundaries because of their primary role in the exhumation of the unit. However, some structural discontinuities such as shear zones, thrusts and normal faults have been reported within the HHC, with different roles with respect to the exhumation history from Bhutan (Davidson et al., 1997; Grujic et al., 2002) to Nepal (Hodges et al., 1996; Mcfarlane, 1995; Maruo and Kizaki, 1981; Searle, 1999; Goscombe and Hand, 2000).

The superb exposure of the crystalline units in Lower Dolpo (western Nepal) allowed to unravel their structural and kinematic evolution and to identify a ductile, high-temperature, shear zones in the middle portion of the HHC, in the Gorpung Khola valley.

The shear zone (Toijem Shear Zone) is localized in the middle part of the HHC at the

boundary between Formations 1 and 2. Kinematic indicators show a top-to-the SW sense of shear. HHC underwent an eohimalayan phase of metamorphism reaching, in the study area, the kyanite grade followed by a neohimalayan phase testified by abundant growth of sillimanite on shear planes during the exhumation.

Geometric, kinematic and petrological data indicate that the high-temperature Toijem Shear Zone developed during the exhumation of the HHC enhancing the decompression of the hanging wall and the emplacement of leucogranite dykes and sills.

TSZ is responsible of an heterogenous velocity path in the central portion of the exhuming unit with the hanging-wall that moved faster upward and southward with respect to the footwall rocks. This suggests that major lithological breaks (such as the boundaries among the Formations of the HHC) could exert a strong influence during extrusion of the whole teconic unit allowing the concentration of deformation and affecting the velocity path of the extruded unit.