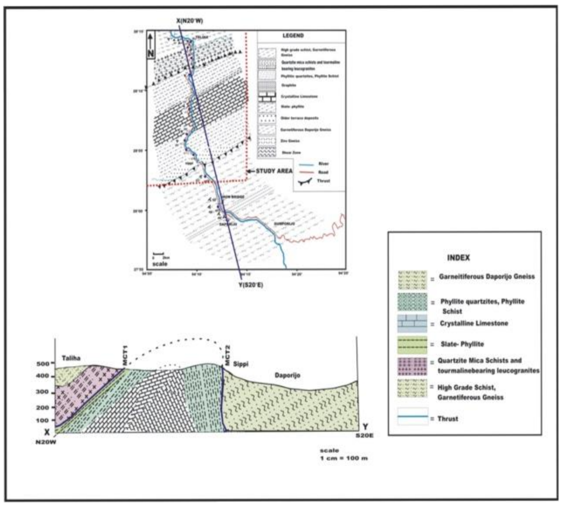

Figure 2: The geological map of the area around Taliha along with a cross section along N20°W-S20°E shown. MCT is folded and MCT-2 is reappearing near Daporijo.

Leucogranite are forming some asymmetric sigmoid with right lateral shear sense. This indicates that MCT zone at this place represent a ductile shear zone with various kinematic indicators showing top to the NE or to the ENE sense of shear. The higher Himalayan crystallines in the north of MCT zone show three phases of deformation followed by a brittle phase towards the waning phase of the deformational history.

II. MICROSTRUCTURES

A. Intrafolial folds

Rootless intrafolial folds are common in the mylonitic gneisses and schist of the Higher and Lesser Himalayan sequences of the area. Their axial traces dip to the ENE or ESE directions (Fig.3e) which indicate top –to- ENE or top- to- ESE sense of shear. The enveloping surfaces of these folds are composed mostly of mica and define the C-surfaces [7].These folds define class 2 type of shape [9]. These rootless folds indicate very high level of shearing which led them to be broken from the limbs of the train of folds of the earlier generation.

B. Mineral fish

Mineral fish are lozenge-shaped Porphyroclasts, single crystals in a finer grained matrix, which occur in ductile shear zones and which are commonly used as shear sense indicators. Mineral fish of biotite, tourmaline, K-feldspar, garnet, hypersthene and quartz occur in mylonites but most common are white mica fish. These mica fish can be subdivided into different morphological groups that develop by different mechanisms determined by different initial shapes and orientations. The principal mechanisms of formation are intracrystalline deformation combined with rigid body rotation [10].

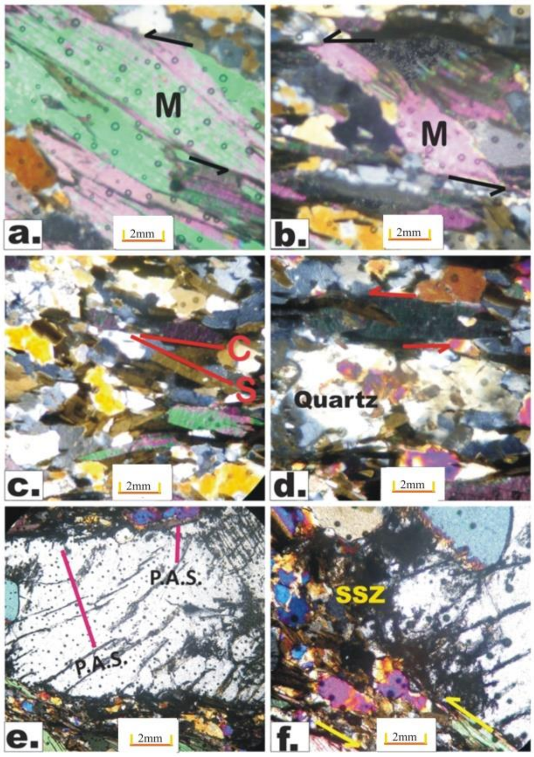

Figure 3: a & b: trapezoid shaped mica show left lateral top-to-NE sense of shear with the angle between the mica and the shear planes around 30-35o. c. The angle between the S and C planes reduced to around 15o. d. Quartz fish with notch at one end shows top-to NE sense of shear. The rootless intrafolial folds with sheared out limbs (see lower part of the photograph) e. Pull apart structure in a feldspar porphyroclast showing to-to-the NE sense of shear. f. The marginal part of the previous photograph enlarged shows rootless intrafolial folds.

In the studied thin sections (Fig.3a and b) the micas show left lateral (top-to NE) shear senses while in the Fig.3c the angle between the S and C is nearly 15o. Quartz fish with notch at one end shows top-to NE sense of shear (Fig.3d).In fig.3e, a parallel pull apart or a boudin of feldspar grain with the highly sheared mica and quartzo feldspathic minerals show prominent top-to –NE sense of shearing. The marginal parts with the mica and quartzofedspathic minerals are magnified in Fig.3f. The rootless intrafolial folds are defined by the quartz grains (Fig.4 a and d). The sigmoid mica fish is affected by top-to-ENE sense of shear (Fig.4b). Weakly parallelogram shaped tourmaline grain also observed to be deflecting the quartz grains in leucogranite dykes along the MCT zone (Fig.4c). Quartz and feldspars in the leucogranite are weakly deformed and only few trapezoid shaped grains are observed (Fig.4e).

C. Other microstructures

Top-to ENE or top-to-ESE sense of shear is mostly shown by the trapezoid shaped minerals mostly by micas. This plane of shearing is defined as Y planes while the trapezoids define the P –planes [11]. The brittle shear planes dip to WNW or WSW and these brittle planes are parallel to the ductile shear C-plane [12]. In some cases the minerals are observed to be strongly fractured and dragged along these planes (Fig.4 f).Top-to-ESE shear is displayed by asymmetric duplexes in mica as observed in Figs.3b and 4b.It has also been observed that micas are most vulnerable to ductile and brittle deformations may be because of their lower competence.

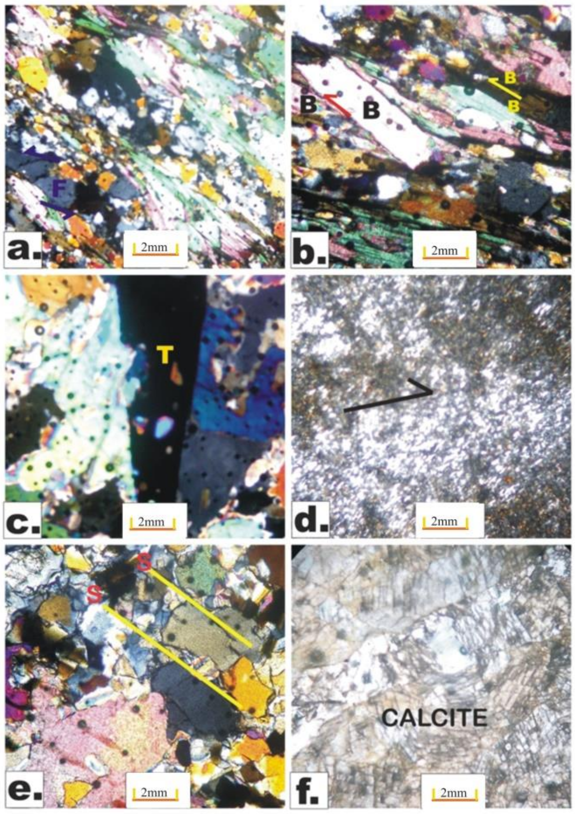

Figure 4 a & b: Trapezoid shaped mica in the mylonitic gneisses indicate top-to-ENE sense of shear. **c** Weakly parallelogram shaped tourmaline grain also observed to be deflecting the quartz grains in leucogranite. **d.** Rootless intrafolial folds in mylonitic gneisses. **e.** Only few trapezoid shaped grains are observed in the weakly deformed leucogranites. **f.** Fracturing followed by dragging of the minerals in the crystalline limestones. The drag is along the C-plane.

III. CONCLUSION

Microstructural study in the Higher and Lesser Himalayan sequence in and around Taliha indicate top-to-the ENE and top-to-the ESE sense of ductile shearing. Since these metamorphic sequences swing from an E-W trend to ENE-WSW trend, there may be combined effect of pure shear followed by simple shear in the development of these microstructures. The asymmetry of the shape and orientations of the cleavage plane with respect to the C-planes served as a reliable shear sense indicators. The brittle Y-shear planes are sometimes very pervasive. The pull apart structure within a large porphyroclast indicates extension during rotation along the shear plane.

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