STRUCTURAL GEOLOGY AND ROCK PHYSICS

The research group contributed to many directions of rock deformation, including fracture mechanics (applicable to earthquake physics), deformation in Himalaya, mechanics of impact craters in India and geo-sequestration of carbon dioxide.

Innovative laboratory experiments performed by the team recognized crucial parameters and factors, e.g., mechanical anisotropy that can trigger damage propagation in an elastic medium containing inherent mechanical flaws. These experimental models allow us to interpret the association of both Mode-I and Mode-II fractures with shear bands. The group has provided a new insight into high-temperature creep processes in ductile regimes, which are especially relevant to the Himalayan orogeny. The group has shown that the microstructure and texture of deformed quartz across MCT directly typify and can be used as reliable proxies for estimating the temperature, strain, and deformation mechanisms. The team also studied the subduction processes of NE Himalaya and estimated the nature of MOHO transition zone together with the deformation mechanism and seismic anisotropies of the high-pressure rocks in the Himalayan subduction together with the development of a robust model to evaluate the dynamic relation between the Himalayan orogenic wedge and the Tibetan plate which suggests controlling parameters for generating sequential thrust and normal faults in the Himalaya.

Another major direction of the Structural Geology research group contributed towards the structural, spectroscopic and rock magnetic evaluation of terrestrial impact craters. The results reveal the deformation pattern in the area and the paleostress direction. The magnetic measurements include the study of the (i) magnetic fabrics (anisotropy of magnetic susceptibility measurements), which reveal the direction of stresses and intensity of strain; (ii) palaeomagnetism, which reveals the movement of the tectonic plate and the rotation suffered by a rock body since emplacement; and (iii) magnetic mineralogy including thermomagnetic measurements, hysteresis and FORC analysis, which reveal the magnetic minerals and their domain state. The group has demonstrated the subsurface ultrafast failure mechanisms triggered by meteorite impact through innovative ultra-velocity deformation experiments. These experiments provide a new way of interpreting crater□forming processes in planetary bodies by showing the post-impact failure mechanisms and dynamic evolution of impact induced breccia-dikes together with their filling processes. 9 In addition, the structural geology research group has made a breakthrough in setting up a sophisticated high-pressure-temperature experimental laboratory for the first time in India