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Structural Geology in the Service of Society

A. R. Bhattacharya

CAS in Geology, University of Lucknow, Lucknow-226007, India

Abstract

Today ours is an industrialized society. Industry is possible only due to the use of minerals that occur in rocks situated below the soil cover. Extraction of minerals is possible when we know the structure of the rocks that we can know only through Structural Geology that encompasses study of all aspects of the deformation structures in rocks. Role of structural geology in society is thus inevitable. Despite its great utility, structural geology has always been under-represented in all societal issues as compared to other branches of science. Structural geology plays a great role in the exploration of minerals of great economic value due to association of several minerals with some specific structures. Structural studies are important for selection of sites and construction materials for dams, tunnels, bridges, airports, roads, buildings and civil engineering projects, exploration of petroleum and groundwater and the related aspects of human needs. And now, when our living environment is under anthropogenic overpressure, structural geology also extends its services to our society.

We now highlight some common aspects of structural geology that have great societal implications. Bedding (presence of beds or strata) constitutes an important structural factor for stability or instability of an area. Depending upon the dip-slope relationships, an area may be considered stable when dip and slope are perpendicular or unstable when dip and slope are parallel. Bedding plays a dangerous role when weak rocks occur intercalated with hard rocks. Folds (bends in layered rocks) may show damaging effects on their limbs especially due to the presence of weak rocks or sufficient micaceous layers and/or axial-plane foliations. Faults (fractures along which two adjoining blocks of rocks have moved past each other) often constitute storehouse for petroleum and groundwater, but may turn destructive to civil constructions under several geological situations. Large faults often constitute pathways for release of untold energy from inside the earth in the form of earthquakes of various magnitudes. Joints (cracks in rocks along which there have been little or no displacement) that commonly hold water below the ground may play foul sports causing environmental instability to an area. Shear zones (an intensely deformed zone in rocks bounded by two parallel planes) when subjected to enormous artificial overload, may trigger two blocks of rock masses slide/slip past each other thus causing damage to any superstructure. In general, structures like faults, joints and shear zones add anisotropy to the rock masses thus making the host rocks weak, while lithology (rock composition) greatly controls the intensity of damage to the associated civic constructions.

Structural geology thus plays a great role in the society (1) in the exploration of minerals of great economic value as well as of petroleum and groundwater, (2) in civic constructions, (3) in identifying environmentally suitable areas for human habitation, and (4) in mitigating several harmful geogenic hazards and furious phenomena.