Quality initiatives outside the University (Geo-Heritage sites)

Internal Quality Assurance Cell (IQAC), Kumaun University, Nainital

Future Initiative of IQAC
Proposal for establishing the GEOHERITAGE SITES for GEOTOURISM

The proposed geoheritage sites are situated in the Kumaun Lesser Himalaya, which forms an integral part of the larger Himalayan orogeny. The Himalaya, an awe-inspiring mountain range, are primarily composed of crustal components that were once part of the northern Indian lithosphere. These components, which have existed for several hundred million years, have played a significant role in the geodynamic evolution of the Himalaya and have helped shape the landscape during the mountain-building process. Moreover, these components have been instrumental in creating a habitable environment in the Himalaya, making them essential to the ecology and biodiversity of the region.

(To be submitted to UCOST/Tourism Department of Government of Uttarakhand)

Geoheritage Sites of Kumaun Lesser Himalaya

Geoheritage Site 1: Main Boundary Thrust (MBT) Zone in the outer Kumaun Lesser Himalaya showing tectonic contact between the granite (1850 Ma old) and metavolcanics (Bhowali volcanics) containing the enclave of Siwalik sandstone.

Location: Amritpur village, Nainital

Significance of site: The Main Boundary Thrust (MBT) is a crucial geotectonic feature in the Lesser Himalaya region. It is a dividing line between the Siwalik and Lesser Himalayan rocks. The MBT zone is particularly well-exposed in the Amritpur village of Ranibagh, situated in the Nainital District. The Amritpur granite has mineralogical and geochemical features corresponding to peraluminous (S-type) granite formed around 1850 Ma ago by melting the pelitic source rocks. This granite is in contact with the metavolcanics (green-schist and amphibolite), containing a tectonic tongue of red, ferruginous, Siwalik sandstone (Fig. 1). These features are located within the MBT zone and are spectacularly exposed in the Gaula River section of the Amritpur. The MBT extends regionally from the NW to the NE Himalayan Belt.

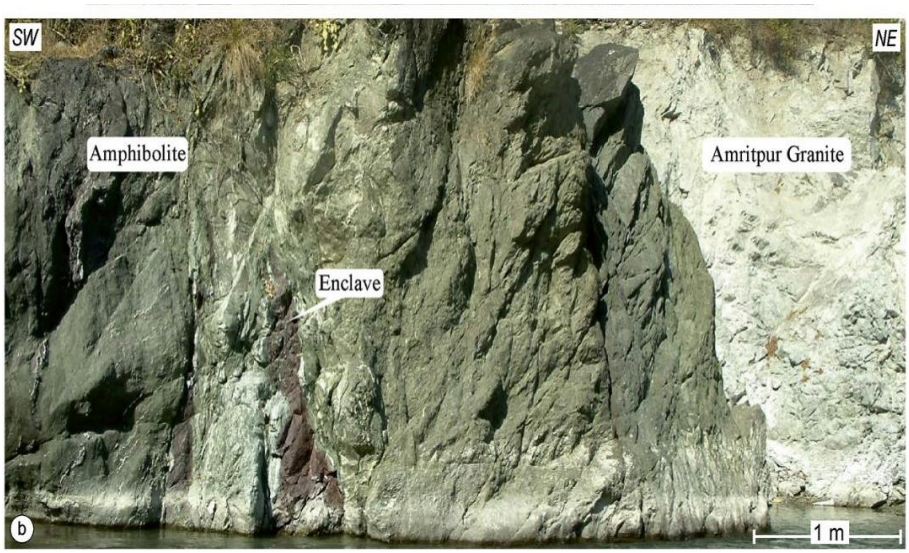

Figure 1 The granite in contact with metavolcanics containing the tectonic tongue of Siwalik (red coloured ferruginous sandstone), which lie in the MBT zone. .

Geoheritage Site 2:

Location: Quartzite alternating with volcanics in Bhowali (N 29^0 24' 41", E79^0 31' 1")

Significance of site: Quartzite is a type of rock that forms from sandstone during the process of metamorphism. In the Bhimtal and Bhowali areas, the Bhowali Formation comprises alternating bands of quartzite and metavolcanics, which are deformed lava rocks. The quartzite and metavolcanics can be observed in various locations. Quartzite is composed of detrital zircons, a mineral highly resistant to erosion and can survive during rock or tectonic cycles. The zircons in the quartzite have a crystallization age of ca 1850 Ma and morphological characteristics similar to those found in the Amritpur granite. This indicates that the maximum depositional timing of the quartzite should be approximately 1850 million years old. Therefore, the metavolcanics deposited synchronously with the quartzite must have erupted no earlier than 1850 million years ago. Overall, the study of the quartzite and metavolcanics in the Bhowali Formation provides valuable insight into the geological history of the region.

Figure 2: The outcrop of quartzite exposed in the Bhowali region of outer Kumaun Lesser Himalaya.

Geoheritage Site 3:

Location: Quartzite over the granite gneiss Chiplakot (N 29^0 53' 46", E80^0 34' 64")

Significance of site: In the vicinity, a towering outcrop of quartzite (Fig. 3) extends to a height of about 50 meters. It is a type of metamorphosed sandstone rich in micaceous minerals, particularly muscovite, and contains carbonaceous pods. The quartzite is exposed in association with metamorphosed granite, called granite gneiss. The granite gneisses form the basement upon which the quartzite is located or deposited around it. The zircons found in the granite gneisses reveal the youngest age to be around 1700 million years. Morphologically, these zircons share characteristics and crystallization age similar to those in the granite gneisses. This implies that the maximum depositional age of the quartzite should be 1700 million years old.

Figure 3: The outcrop of quartzite exposed in the Chiplakot region of inner Kumaun Lesser Himalaya.

Geoheritage Site 4: Granite and enclaves (interaction of crust- and mantle-related magmas)

Location: In and around Devidhura region in the Champawat

Significance of site: The Champawat district of Kumaun Lesser Himalaya is a region where granites, which are light-coloured and rich in silica, are extensively found. These granites are unique because they contain dark-coloured rock patches representing silica-poor mafic magmatic rocks, known as enclaves. The enclave is enclosed in granite (Fig. 4), which indicates that there was mixing and mingling of mafic and granite magma in deep-seated environments. The mafic and granite magmas, about 500 million years old, originated in different places. They were placed in a chamber where they coexisted and interacted due to their contrasting temperatures and compositions. This mixing and mingling of magmas is a fascinating geological process that helps us understand how different types of rocks can interact with each other in the Earth's crust.

Figure 4: The granite encloses the enclave in and around Devidhura region of Champawat district.

Geoheritage Site 5: Isoclinal fold developed in the quartzite of Almora Crystalline

Location: Khatyari Village (N 29^0 35' 28" E79^0 38' 39")

Significance of site: The village of Khatyari in the Almora district is a great place to witness the fascinating geological phenomenon of folded rocks. The rocks in question are metamorphics belonging to the Almora Crystalline formation, and they display various features such as folds, lineations, and schistosity planes. These structures were primarily formed during the mountain-building processes that shaped the region over millions of years. The isoclinal folds (Fig. 5) observed in the Almora Crystalline rocks are of significant scientific interest. They provide a clear demonstration of how pre-existing rocks are folded under the compression regime that characterized the Himalayan orogenesis. These close-to-tight folds were formed due to the buildup of stress during the orogeny, offering valuable insights into the geological processes that shaped our planet. The shown fold, where the limbs dip opposite each other, is an excellent example of first-generation folds that developed in the quartzites of the Almora Crystalline rocks. These folds are a testament to the immense forces that shaped the region and offer a glimpse into the geological history of the area.

Figure 5: The close-to-tight folding developed in the quartzite during the Himalayan building processes, exposed in the Khatyari Village of Almora District.

The Model Signage and Board for Geoheritage Sites (similar to this we have to prepare)


Supervulcano del Sesia
Supervulcano del Sesia


IL SUPERVULCANO DEL SESIA
The Sesia Supervolcano
Isola di Vocca - Deformazioni nella crosta profonda
Deformations in the lower crust

The above pictures are from Geoheritage sites of Italy where I visited during last September 2023.

(Santosh Kumar)

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