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Physical Land Features and Environmental Studies of Siwalik Rangers between Ganga and Yamuna River (U.K.)

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Abstract: ***This Paper discusses physical landscape, structure, climate, vegetation, altitudinal belts of the study region. The geological structure of the region is termed as Outer Himalaya i.e. Siwalik range. The Siwalik formations are separated by MBT in the north from pre-tertiaries. These ranges also include Mohand anticline and Motichur syncline.***

Keywords: Dhang- Raised land mass near river bank is known as 'dhang' in local dialect.

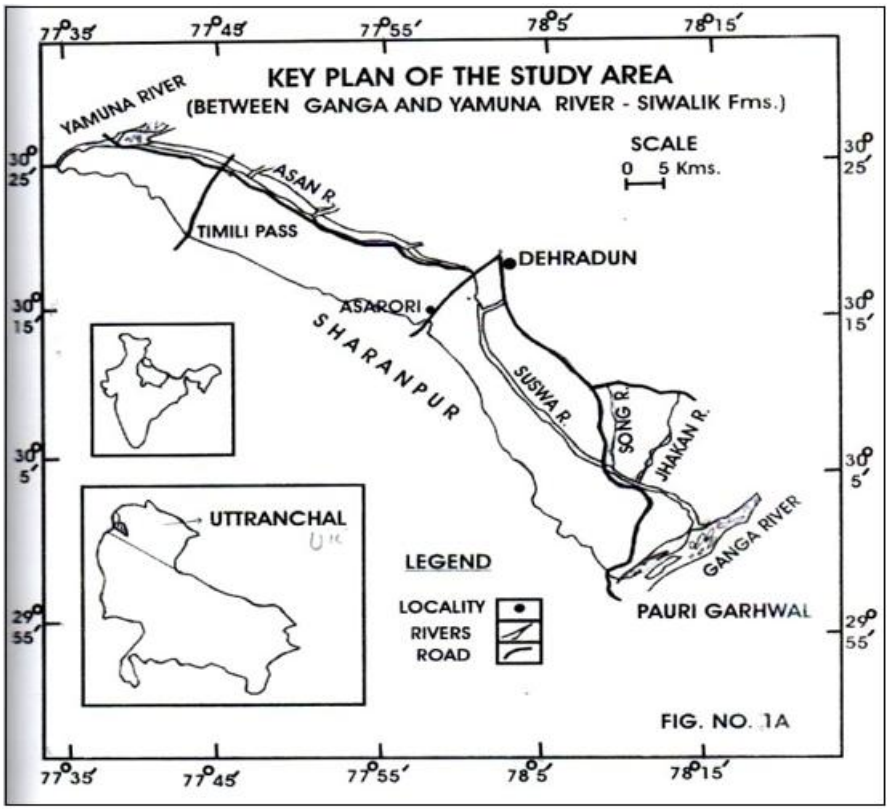
1. Introduction

The relief of the region is apparently a single slope hill structure drained by two rivers Suswa and Asan i.e. Suswa flowing from north-west to south-east and Asan flowing north-east to south-west to meet Ganga and Yamuna rivers respectively. The drainage being swift, the area is dissected by number of seasonal streams. The altitudinal range is in between about 300 m at foothill to 100 m at the crest.

The soil of the region is mostly the resultant product from the erosion of the Siwalik and has been classified as boulder belt and Siwalik belt. The geomorphic process includes regional uplift, differential uplift, block faulting giving rise to fault scarp, structural hills (Nagsidh hills), piedmont slope, pediment high and low flood terraces. The climate of the area is subtropical to sub-temperate. Vegetation includes moist sub-forests, mixed deciduous forests, submontane hill valley swamp forests and dry deciduous forests.

This paper ends in classifying the entire region into two major physiographic regions namely

1) The northern part, i.e. the syncline trough forming part of Dehradun valley containing Pleistocene and Holocene terraces, gravels, pebbles etc.,
2) Continuous chain of hills of Siwalik sandstones and shales, clay and conglomerates.



Physical Landscape

The area between Ganga and Yamuna, consisting of Siwalik formations, is an irregular rectangle in shape with its North-western part more taper than the South-eastern part. The longer axis of the area is almost parallel to the strike of the Siwalik i.e. the larger axis is trending in N.W.–S.E. direction. The area is enclosed between the two most prominent antecedent rivers of Indian sub-continent. The north western part of the area is transversely closed by the river Yamuna and river Ganga forms the south eastern proximity of the area. To the North in western part the area is enclosed by river Asan flowing East-West which is a tributary to river Yamuna and in eastern part the river Suswa (Song) forms the extremity of the area under investigation which flows in south eastern direction to confluence with river Ganga. Thus the region is bounded by river Yamuna in N.W. and Ganga in S.W., rivers Asan and Suswa in the north. To the south, the Siwalik formations present a steep face.

Structure

The area between Yamuna-Ganga rivers forms a part of the sub-montane region of the outer Himalayan ranges known as Siwalik[1]. The Lesser Himalaya lies in the north beyond Doon Valley. Geologically the valley is subdivided into the following sub-units:

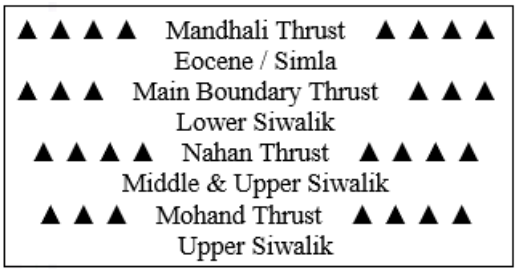
1) A synclinal trough, comprising of Holocene (the Dun gravels) and Pleistocene terraces.
2) The Siwalik range in the south are composed of middle and upper Siwalik conglomerates, sandstones, shales and clay

In the north part of the area occurs Dun gravels, alluvial and colluvial terraces of Pleistocene to resent age. In the south the Siwalik range represents mollase group of rocks which followed the rise of the Himalaya in the north. The contact between the Siwalik and Dun gravels (Holocene and Pleistocene) of the frontal Himalayan range has been named as Main boundary fault (Medlicott, 1864) (Nowhere exposed in the area of investigation). The Siwalik shows a rise of about 30 cm (1′) as experimented by the Seismologists at various times.

The foot hills can be sub-divided from south to north into three units (Podder, 1962) as mentioned below :

1) The outer folded belt of Siwalik showing the development of a few anticlines having a steep southern limb and a comparatively low dip on the northern limb affected by the offset faults.
2) The thrust zone of the Siwalik is affected by a set of reverse faults causing in general, the repetition of the lower Siwalik exhibiting steep dip towards north.
3) The Dehradun valley is situated in between the outer folded belt and the thrust zone of the Siwalik.

A glance at the tectonic map of the study region shows the presence of numerous faults and thrusts. The lack of fossils (Mithal, 1968) together with occurrences of similar rock types in different formation has added to the problem of correlation, classification and proper elucidation of the structure of the region. The tectonic succession of the region[1] can be summarized as noted below:



The Main Boundary Thrust, the Nahan Thrust and the Mohand Thrust are well defined and differentiated on the basis of fossil evidences which though not occurring in the present region but are found in the neighbouring areas to the east and the west.

Medlicott (1864) stated that “the Siwalik range, south of Dehradun is for the most parts formed on the northern side of a great irregular anticlinal flexure”. Structurally, the Siwalik sediments are exposed in the form of a big longitudinal anticline known as “Mohand Anticline”. The north-eastern limb of the structure occupies most part of the area while most of the south-western limb is concealed by younger gravels and alluvium. The surface trace of the anticlinal axis trending in west north-west to east south-east direction is traceable very clearly near Mohand village of the area.

The rocks on the north-eastern limb of the Mohand anticline have gentle dips in the north-east direction, while they are steeply dipping on the south-western limb. However, there is a great deal of irregularity in the configuration of the two limbs. The north-eastern limb on the whole is more regular than the south-western limb, the latter exhibiting much variation in the amount and (1) Steep limbs of the minor anticline and drag folds.
(2) Majority of the small faults had towards north-east and they are reversed.
(3) Geomorphologically, the area occupied by the north-eastern limb seems to have been elevated more than the south-westerly alluvium covered one thereby exposing older rocks in the north-eastern limb at more or less the same level of erosion. The south-westerly limb of the Mohand anticline with comparatively younger sediments in contact with the older sediments of the north-eastern limb.

Petrologically the parent rocks of the soil in the area consist of shales, slates, conglomerates, talus cones, thick purple semi-nodular clay and sandstones.
(ii) Geomorphic Processes:

1) Regional Uplift :

The rejuvenation caused the incisions in the river valley like ingrown and entrenched meanders of the Dun, resulting in the formation of the terraces. On the basis of the age of the terraces, the soils may form calcareous and pavements, through leached inceptisol and alfisols. The colour of this chronosequence vary (from young to old) from grey through greyish, yellowish brown to yellowish red and red.

2) Differential Uplift:

This type of uplifting is visualized between the Siwalik hills and the alluvial cover of the Dun, and it has caused varying steepness in the gradient of the rivers and small streams.

This has greatly influenced the texture of the soil. For instance, the river Ganga has deposited coarse material on its banks (dhangs), while the river Yamuna has deposited fine textured alluvium on its terrace. The central part of the Dun, consisting of the finer material, deposited by the rivers Suswa and Asan, forms a flat to gently sloping old plain of 10 metres (33') thick fine silty and clayey soil on which old clay soils with textural and B horizon have formed.

3) Block Faulting:

It has been a process to bring a change in parental rock of soil with the result, the older surfaces have been raised out of the later sediments. The surfaces being relatively higher from the local base level consist of old soil. The monodonacks of old piedmont fan surfaces are found as sedimentary caps of overlying hills with Siwalik core. The incision of the streams due to regional uplifting of block faulting gives rise to widespread erosion which removes the humus rich top soils under forests. Sometimes the extremity of the erosion prevents the formation of the textural and B horizon.

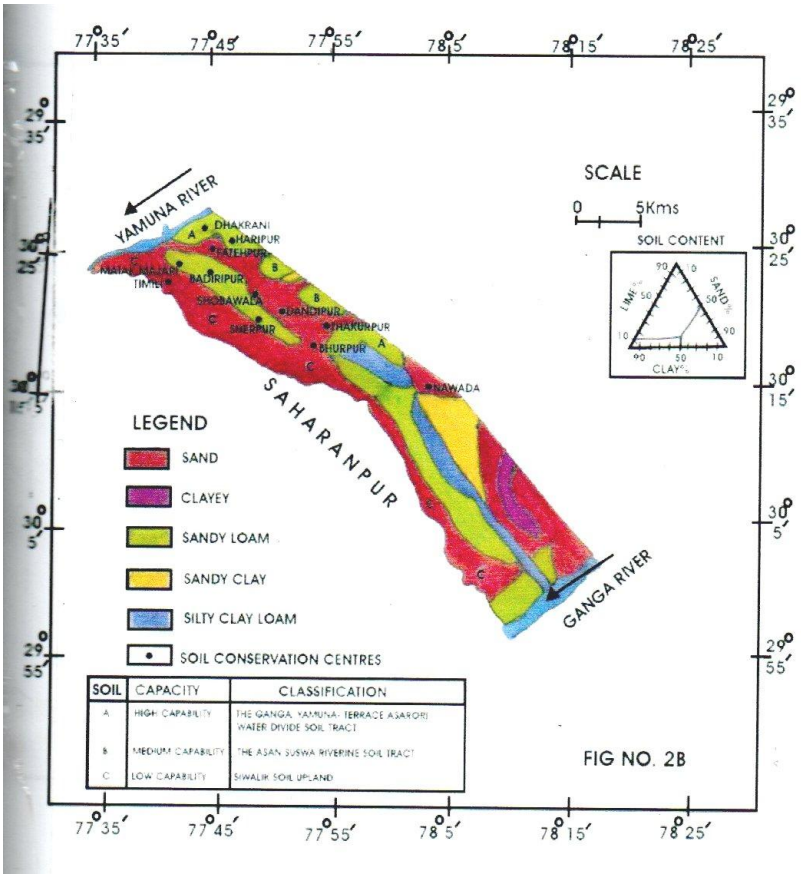


FIG NO. 2B

(iii) Phytogeographic Factors:

The region is more of less well covered with natural dense and scrubby type of vegetation and forests. The Dun gravels (The boulder belt) present a very thin coverage of vegetation. Consequently, it has a little amount of humus as compared to the Siwalik in the south of the Dun. The present study reveals that the land covered with scrubby and forest vegetation has generally clayey and dark coloured vegetation, gradually becomes sandy and sandy loam in nature.

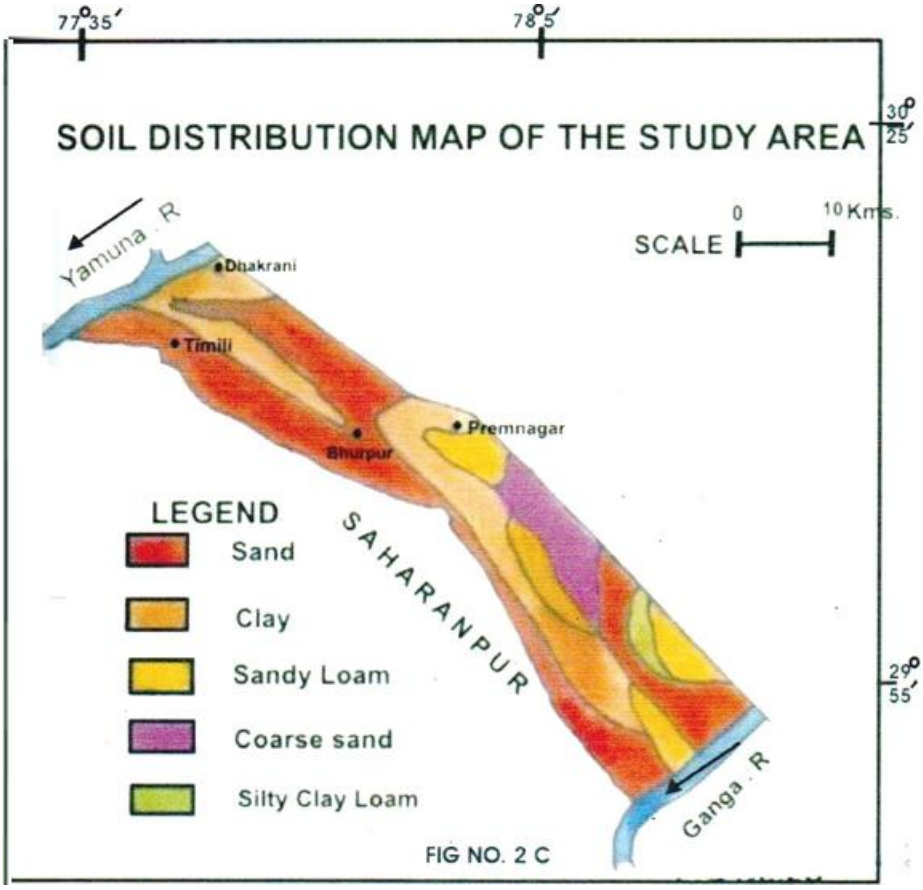
(iv) Genetic Factors:

The catchment areas of various streams have an influence directly on the properties of the various sediments deposited by them. the rivers Ganga and Yamuna bring micaceous materials, streams from Lesser Himalayan drainage line calcareous materials in the Dun, while the streams from the Siwalik drainage line bring down siliceous materials.

Similarly there is a great difference in piedmont fan material in the Himalayan belt and Siwalik belt. The piedmont material from the former is composed of coarse fraction of platy shales, slates and latter consists of pebbles, cobbles and gravels at varying depths below the soil surface. The genetic relation and the petrological studies show that the soils of the region falls in two main belts viz., The Boulder belt and The Siwalik belt (Joshi, 1970).

1) **Boulder Belt:** This part includes the boulders, shingles and gravels of great thickness. The soil cover is sandy and poor in clay. The soils are feebly leached and are less acidic in nature. The process of infiltration, in action with upper piedmont slopes and braided river bed in Suswa leading to the formation of hydromorphic soils in the lower terraces and the lower reaches of Suswa river.
2) **Siwalik Belt:** This belt is characterized by conglomerates, sandstones and thick bands of clay (Pandey, Verma and Anantharaman, 1983). The soils resulting from these rocks are sandy loam with a large proportion of clay i.e. 50% (Saxena, 1975, Figs. 2B & 2C). On the higher slopes the soil cover is very thin and dry and on the lower slopes it becomes thick. It is observed that the outer dip slopes of the Siwalik belt, facing Dun, consist of clayey soil (Figs. 2B & 2C). The Motichur syncline is covered by this soil. The lower

colluvial slopes have coarser textured and gravelly soils. Lower Siwalik and Nahan sandstones produce fine silt and clay.



The classification[1] of the soil of the area is as follows:

1) **Goyand**: It is very good clayey friable, fertile soil devoid of pebbles and stones. It is deposited below the spurs.
2) **Rausli[2]:** It is a medium sandy soil consisting of some pebbles.
3) **Dakra:** It is good, brownish, clayey soil and is found in lowlands.
4) **Sankra:** It is the fertile soil in the area. The soil capability given below is based on chemical composition of the surface soil with depth, slope, erosion, soil moisture infiltration and present land use (Saxena, 1975).
   a) **High Capability:** The Ganga-Yamuna terraces and water divide soil tract – The soil is rich in humus and the slope is between 7.5 and 15 metres/1.6 km (25'-50'/mile).
   b) **Medium Capability:** Asan-Suswa riverine soil tract – Mostly the alluvial material is completely spread over the riverine, old beds of Song, Suswa and Asan and also the Holocene fans. It is medium soil with 20 to 30% of clay. The soil is coarse textured and brownish in colour.
   c) **Low Capability:** Siwalik soil upland – The soil of this group is sandy loam. The gradient is between 151 and 303 metres/1.6 kms (500'-1000'/mile) and the soil cover is very thin.

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