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GEO-MORPHOLOGICAL ANALYSIS OF LAND FORMS AND DRAINAGE PATTERN AROUND TARANA AREA (WESTERN M.P)

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ABSTRACT

The present study, around Tarana has been carried out to evaluate the effect of physical framework on the behaviour of ground water bodies. Landform study and drainage analysis indicate the three recharge zone in the North-East, South-East and South-West part of the area whereas discharge zones are situated in the central part of the area.

***KEYWORDS*: Geo-morphological, analysis, land, Tarana, Western M.P**

STUDY AREA

The present study is carried out to determine the hydrological conditions of the aquifers around Tarana. The area surveyed is around the town Tarana, lying between the longitudes 76° 58' and 76° 30", and latitude 23° 15' and 23° 22'. It is a part of the toposheet No. 55 A/3, and includes a small portion in the toposheet No. 46 M /15 towards North-East of Ujjain district of Madhya Pradesh. The area constitutes a part of Malwa Plateau of the Deccan Trap Volcanic Province. It covers an area of 350 Kms.

Landforms are the erosional and depositional relief features. Physiography and general landscape of all the platue hills are flat topped .The area surveyed is a plain, sloping from South to North, in West & South-East to North-West. in the East of Tarana.

The highest elevation point in the area is in the east and is 529 mts., above M.S.L. near Sadikhari village. The surveyed area lies between 484 m, to 529 m above M.S.L. with slope from North-East to South. Pre trappeans in the area are hidden below the Deccan Traps and are not exposed on the surface. At the end of

cretaceous period trap flows erupted through the weaker zones or fractures. The Deccan Trap of the area belongs to the middle traps. First lava eruption occupied the preexisting topography and has spread laterally having practically, no or low dip as that of older formations. Later on successive flows spread over first flows and they too extended laterally and thus formed nearly horizontal basaltic flows.

The trappean topography was subsequently suffered by various weathering agencies. The differential weathering of trap is the main cause of such type of topography. The hills show step like appearance which is the characteristic feature of the Deccan trap.

The topographical features of the region are also perhaps due to the nature of lava flows and their lithological variations.

DEVELOPMENT OF LANDSCAPE

For interpreting the formation of land forms, the geological and structural features of the area, the form of rock bodies, Lithology, climate and other environmental factors should be taken into consideration.

Geological history of the area reveals that the lava flows are the basaltic lavas erupted through the fissure during the Deccan Trap period, by virtue of the less viscous nature of the liquid, it was highly mobile and flowed over wide areal extent with hardly any change in its composition. (West 1959)

Further, there had little change in the composition of the lavas erupted with an intermittent period of quiescence between the two successive eruptions. The horizontallity of the lava flows, with a fair degree of uniformity in the rock type have considerably simplified the changes brought by the secondary processes like weathering and denudation. The continuous action of the degradational agencies, possibly with fluctuation in intensity of forces, had brought horizontality of the lava plains even after denudation. This is true of the vast monotonous plains of Daccan Traps.

Thus the present landscape is the resultant affect of the natural agencies for such a prolonged period. Considering the differences in the topographical forms, drainage pattern, weathering character of the rocks, development of different soil types, divergent potentialities of ground waters, it would be necessary to assess the utilization of land resources on the geomorphic evolution of the area.

The periodical invasion of the flood waters on the adjacent land (near Chhoti Kalisindh River) leaves; fertile alluvium for the benefit of the people on one hand while on the other hand destroys some of their constructions.

GEOLOGICAL HISTORY OF THE AREA

Megascopically the rocks are uniform, in general petrographical characters and are basaltic in composition.

Volcanic breccia or other products are absent, which are usually found in the central type of igneous activity.

Lava flows found in the area are horizontally disposed and spread over wide areas without any significant variation.

This view finds its application in the area. There was a time gap between the two successive lava flows represented by the red bole bed.

GENERAL STRUCTURAL FEATURES IN THE AREA

The trap area can be characterized by flat topped hills and step like terraces due to horizontal lava flow and weathering of the less harder and mass soluble in rain water. In the Amygdaloidal flow, the top is usually highly vesicular, the middle is fairly compact and bottom showing cylindrical pipes filled with secondary material like zeolites, calcites etc., But in other flows the top is fine grained and the lower part is coarser. Flows with vesicules and without vesicules may be alternate .or the flows may separated by thin beds of volcanic ash or scoriaa and by the Lacushine sediments known as the intertrappear" beds.

LAVA PLAINS IN THE AREA

A greater part slope and generally covered of the area is covered by the smooth lava plains with gentle I by Black cotton soil.

The rock type of the lava plains on the area is mostly basaltic in The rock type in the area show a fair degree of uniformity in lithological composition. The lava flow and petrological characters. The plains are under intensive cultivation for various crops, at Soya been etc.

ALLUVIUM PLAINS OF THE AREA

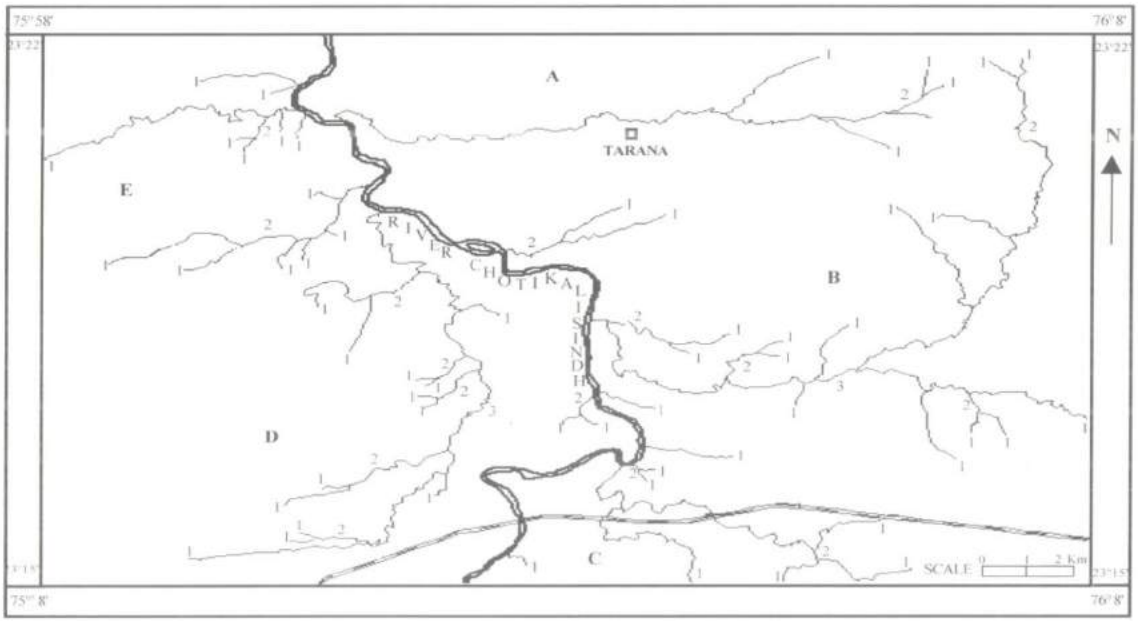
As a result of the river deposits, alluvial plains are occupying an area of about 30% along the bank of the river Chhoti kali sindh. Alluvium is also found near courses of the major nalas.

They are formed of the sediments deposited by river system, either by run off or by the floods, and constitute of clay and sands. Sand bands or sandy clay bands with pebbles are also present.

DRAINAGE PATTERN

A drainage pattern may be defined as a plain metric arrangement of several streams which are usually adjusted to certain topography structural or lithological control.

Fig. 1.1 Drainage map of the study area



Surface drainage is an important parameter in the hydrogeological investigations. Drainage pattern reflect the infiltration potentialities of the various formations in a region. Further the relation of the drainage to the ground water level contours enables the delineation of area of effluent and influent streams. Drainage study involves the study of drainage pattern and drainage texture. The development of drainage in any area is controlled by the Geology, structure, relief, climate and attitude. It is also influenced by initial slope, earth movement, volcanism and Geo-morphological history of the area.

In the present study the main drainage in the area is controlled by the river Chhoti Kali Sindh which flows in the northerly direction and tributaries of Lakhunder river, which forms part of eastern boundary of the block. River Chhoti Kali Sindh is perennial with frequent meanderings. Its tributaries are small nalas with seasonal flow.

River Chhoti Kali Sindh flows through the alluvium at few places having thickness of 5m to 15 m. followed by jointed, fractured and weathered trap rocks. The whole area falls under Chambal river basin. Most of the tributaries of river Chhoti Kali Sindh are dendritic in nature and divided the area into various sup basins.

Two types of drainage patterns are identified in the area: -

(i) Dendritic drainage pattern.

(ii) Sub-parallel drainage pattern.

DENDRITIC DRAINAGE PATTERN

The term was first used by I.C.Russel (1898) but was defined much later by Clenard (1916) as a non-systematic and tree like branching pattern. The dendritic drainage pattern develops in all the direction and is characterised by irregular branching of tributary streams in all the directions, without any systematic alignment. The tributaries join the main stream at any angle. The presence of dendritic drainage implies a lack of structural control. This is the most dominant pattern covering most of the investigated area. Dendritic drainage pattern is well developed in the area around Sadikheri, Bijpadi, Dubli, Birgod, Natakheri and Bagoda villeges.

On fine textured material with a moderate tilt, the dendritic deposition becomes elongated. The angle of junction becomes more acute. The resultant pattern is a transition between dendritic and parallel drainage pattern. This pattern is called sub-dendritic. In such a case slope plays an important role. In the central part of the investigated area, sub-dendritic drainage pattern appears in alluvium formation near Alukheri, Sheopura, Sadwa villages.

SUB-PARALLEL DRAINAGE PATTERN

Zernitz (1932) states " drainage pattern in which the stream are oriented in a similar direction, but which lacks the regularity of the parallel pattern may be designated as sub parallel. The streams may be sub parallel due to slope control or due to alignment of some topographic features. The sub parallel pattern is a transition between parallel and dendritic pattern. In the investigated area, parallel pattern appears in alluvium and weathered basaltic formation near Raipura, Kharpa, Kanwalikhera and Palduna villages. The sub parallel drainage patterns of the area are also controlled by the slope.

DRAINAGE ANALYSIS

The analysis of drainage basins either as single unit or as group of basins, which has been taken to gather, comprise a distinct Geo-morphological region, and has a particular relevance to geomorphology (King 1971). Morphometric study of drainage helps together information regarding the factors that control the development of the drainage. Besides understanding the stage of development of drainage, it also helps to understand the development of erosional work.

The dimensional analysis form a sound basis for the study of geometrical and mechanical aspects of drainage basins. The fundamental dimensions such as length , mass and time used as single or combined as products are enough to define all geometrical and mechanical properties of drainage basins.

In the present work, for the purpose of convenience, the total basin area has been divided into 5 (five) sub-basins for detailed study. (Table 1.1, 1.2.1.3). These sub-basins, having different stream flow directions, are demarcated on the basis of drainage divide. These sub-basins, were analysed on different major morphometric parameters. The following table gives the details of various sub basins –

Table No. 1.1 Showing - Characteristics of Sub basin in the study area of Tarana Ujjain District, M.P.

Sl. No.	**Morphometric variables**	**Sub basin**				
		A	**B**	**C**	**D**	**E**
1	No. of 1st order stream	07	14	09	15	13
2	No. of 2nd order stream	02	04	02	05	02
3	No. of 3rd order stream	-	01	-	01	-
4	Total No. of streams (N)	09	19	11	21	14
5	Total length of streams (L)	16.5 km	32 km	12 km	9.5 km	10 km
6	Area of sub watershed (A)	85.25km^2	101km²	49.25 km^2	66.5km^2	48 km²
7	Length of sub watershed (L)	9.5 km	11.0km	9.5 km	9 km	10 km
8	Width of sub basin (km)	8.9km	9 km	5 km	7 km	4.8 km
9	Perimeter of sub water shed (P)	25 km	31 km	26 km	24 km	22 km
10	Highest elevation with sub basin	529 m	526 m	510 m	500 m	500 m
11	Lowest elevation with sub basin	495 m	487 m	484 m	495 m	486 m

Table No. 1.2 Comparative table of morphometric parameters of drainage basins of the study area

S.No	Parameter (Notation)	Formula	Sub watershed				
			A	B	C	D	E
1	Stream frequency (Sr)	N/A (1/km^2)	0.01	.018	0.22	0.31	0.31
2	Drainage density (Dd)	L/A (1/km²)	0.19	0.31	0.24	0.29	0.29
3	Bifurcation ratio (Rb)	Nu/Nu +1	3.5	3.75	4.5	3.0 5.0	6.5
4	Basin relief (H)	H1-H2 (m)	34	39	26	5	14
5	Relief ratio (R)	H/L	3.57	3.54	2.73	0.55	1.4
6	Form factor (F)	A/L	0.94	0.83	0.54	0.82	0.48
7	Circulatory ratio (Re)	Au/Ac	1.71	1.32	0.91	1.45	1.24
8	Lemniscates (K)	L2/4A	0.26	0.29	0.45	0.30	0.52
9	Length of overland flow (Lo)	1/2 Dd	2.63	1.61	2.08	1.72	1.72
10	Ground surface slope (Sg)	HX 2 Dd	12.92	24.18	12.48	2.9	8.12

CORRELATIVE STUDY BETWEEN DRAINAGE PARAMETERS AND GROUND WATER CONDITIONS

Table No. 1.3 Showing 'relationship of geomorphic features for different basins' in the Tarana area

Basin No.	Drainage density	Stream frequency	Shape of the basin	Ground water conditions
A	0.19	0.10	Semi circular	Favourable Dome patches unfavourable
B	0.31	0.18	Semi circular	Good
C	0.24	0.22	Oval Shaped	Favourable
D	0.29	0.31	Semi circular	Favourable
E	0.29	0.31	Semi circular	Good

On the basis of analysis of land forms and drainage characteristics, the general trend of the ground water flow shows much variations in the area. In the south western part it is found to be towards North-Eastern direction

whereas in the North-Eastern region the flow of ground water is towards South-West side. The flow pattern and drainage analysis indicates the presence of three recharge zone in the North-East, South-East and South-West part of the area whereas discharge zones are situated in the central part of the area. All the sub basins of the areas are characterised by the presence of medium to high vegetation and are subjected to weathering and soil erosion. They are mostly covered by black and lateritic soils.

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