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CHAPTER VI

FINDINGS AND CONCLUSION

This work is an attempt to investigate the rock bed and gravel bed river channel features and their relevance in the evolution of erosional fluvial landscapes.

Bedrock channels normally lack a continuous cover of alluvial sediments, even at low flow, and exist only where transport capacity exceeds sediment flux over the long term. In contrast to alluvial rivers changes along the bedrock channel are usually very less and adjustment in morphology is only related to the high flows. Gravel bed rivers are those rivers which flow through very coarse material in the range of gravel, cobbles and boulders. However they also carry certain amount of fine material along with the flow. These observations on gravel bed rivers are also confirmed by this study.

It has been observed that the bedrock channels cannot substantially widen, lower or shift their bed without eroding the bedrock. The observation is based on the study of large river channels. Literature survey shows that the studies on geometry, fluvial environment, and behavioral characteristics of small basins are still limited in number. This work on Dhul river essentially tries to study the gravel and rock bed channel of a small catchment.

Rivers in semi arid regions of upland Maharashtra are subjected to wide fluctuations in water and sediment discharge. The channel size and channel configuration of these rivers depends on perimeter lithology and the maximum monsoon discharge. The morphology and configuration of river channels in the semiarid zone of upland Maharashtra indicates their misfit form and probably suggests a paleo-flood environment in their earlier stages.
River Dhul drains the area between 18°1' N to 18°7' N latitude & 73°43’E to 73°48’E longitude. It originates on Raireshwar Plateau in the high rainfall zones of Western Ghats of Maharashtra and flows over trappean landscape represented by basalt. The drainage of the river Dhul is dictated by the regional slope of upland Maharashtra. It is a 5th order tributary of river Nira. Total length of the river is 16 km and the overall channel slope is about 24°. The net work development in Dhul river basin is mainly controlled by structure. The orientation of the tributaries and the main stream is governed by joints, fractures as well as differential hardness or weakness of the rock. The basin is not elongated and tends more towards being circular. The low value of drainage density shows that underlain rock is resistant, and the surface is highly permeable with dense forest cover. The maximum height in the basin is around 1340m ASL at the source and minimum elevation is 600 m ASL at the confluence. Relative relief in the basin is around 200 m at the source region. In the area of hill slopes it is 150 m but near valley floor it is only 50m. The slope of the basin from interfluves to valley floor ranges between 25° to 7°. The scarps and free faces exhibit slope between 25° to 21°. Gentle slopes are restricted to pediments and near channel areas.

The river channel experiences bed sediment transport only during high flow stages, with generally slow rate of gravel transport. The sediment which is finer than the bed is transported as wash load in below capacity concentrations whereas grains coarser than the dominant bed size are carried in such small quantities that they are dispersed over the bed, or they may be areally sorted into riffles or gravel bars.

There is no trend of increase in width with distance. Being a bed rock channel it is narrower at bed rock reaches. Channel is deep in the upper sector and shallows in the middle and lower sector with few exceptions. Moving from bank to bank, the velocity is greatest towards the centre of the channel. Midstream velocity is greater than left and right bank velocity. However downstream of Titeghar, at Ambawade and near Sangvi, Left bank velocities are greater than midstream velocity. Channel is dominated by gravel material with some sections of bedrock. In the source region initial input is received from the source and where the tributaries meet the channel. In the source region stream is narrower with large size boulders.
The bed forms in the channel mainly include midstream and point bars, knicks, waterfalls, riffle and pools. There occurrence in the channel is influenced by rock bed or gravel bed sectors in the thalweg. Fig 6.1 to 6.6 show the specific locations where rock bed/gravel bed sectors are found between the confluence and the source. The diagrams also show the along channel locations of terraces and riparian vegetation areas. They amply illustrate the spatial distribution of rock and gravel stretches which is a characteristic feature of the channel under study. The unpaired character of the terraces can also be recognised.

Middle and lower stretches are the rock bed sectors having maximum number of pot holes. Pot holing seems to be a general tendency of the channel bed, it being a rock bed channel. (Fig 4.20) Pot hole study shows that there is a significant variation as regards the dimension and depth of pot holes all along the river channel. Material in the pot holes is of mixed type the dominant being sand and gravel.

Most of the knick points of Dhul channel appear to be controlled by structure. These knicks or breaks are associated with rapids and waterfalls which are succeeded by pools and pot holes on the channel floor.

There are in all 8 point bar and 13 channel bars along the channel. Stream has low competence to carry the load. So most of the material is laid down in the form of midstream and point bars. Most of the bars are made up of sandy substrate and gravel material on the surface. The bed profile location of these bars is shown in fig. 6.7. There appears a general trend of decrease of sediment size in downstream direction. The average height of these channel bars above bed level in the lower sector is 1.5 to 2.3 m. It is 0.5 to 1.7 m. in middle sector and 0.5 to 2.2 m in upper sector. The midstream bars vary in size and shape and are not aligned parallel to thalweg. The sandy deposits on the bar become finer towards the higher ground. The lower areas are invariably covered by coarse sand.
Channel morphology and channel features along Dhul river channel
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The observations regarding the size of sediments on point and channel bars are inconclusive and do not help in the understanding of fluvio-sedimentary depositional pattern in the channel under study. Coarse and medium sand is transported up to the confluence which settles on the bars. Variation in the shape of gravels on midstream bars is also observed all along the channel. Highest proportion of prolate shaped material is recorded in downstream direction. However proportion of prolate shaped sediment decreases considerably on point bars in downstream direction.

The terraces along this river are deposits of unconsolidated fluvial material and is a single stratigraphic unit. These terraces are abandoned surfaces not related to present river discharge. The edges of the terraces are often blurred and gradually merge with upper valley side slopes. These terraces are used by farmers as agricultural land. There appears to be a tendency for these terraces to be nearly parallel to longitudinal profile of the river. (Fig 6.1 to 6.6) Representative study of river terraces along the channel show that the terraces along the channel are mostly unpaired with a scarp and flat tread. Flat tread part is usually covered with vegetation.

The control of perimeter sedimentology is evident all along Dhul river channel. Bed rock control is stronger in upstream reach. High floods are indicated in form ratio (w/d). Flood deposits in Dhul river occur upto 4 m height from bed level. Sand is the major constituent of perimeter deposits all along the channel. Gravels and pebbles are mainly embedded in the matrix of silt and sand as the bank material. On the whole the deposits in the upper 2 to 4 m layers all along the left bank are coarser than those in the lower layer upto 2 m from the bed level.

This pattern clearly indicates earlier high flood conditions. The lower layer finer deposits suggest medium discharge conditions. The right bank deposits also do not show any variation in sorting in upper and lower layers in the downstream direction. Lower layer sediments are negatively skewed at a distance of 14.5 km from the source.
Fig. 6.7
CHANNEL SHIFT IN UPPER REACH
(In last 2 decades)

Fig. 6.8
Such channels rarely show tendencies of shift. The field evidence shows that the channel of Dhul river has shifted northwards in its upper reach by a distance of about 18 m. This shift has slowly occurred in last two decades and has affected the agricultural lands to the north. The earlier position of the river banks could be easily identified from the google images of the area. (Fig.6.8). The channel shift of this type is however restricted to the upper reach up to 6.5 Km from the source. According to locals, this channel shift took place in the years of heavy and concentrated rainfall in 1993 and 1994. The middle and lower reach of the channel does not show such a shift or migration of river channel.

The study shows that the effect and consequences of yearly fluctuations in water and sediment discharge through such a small 5th order stream are very large and conspicuous. The misfit form of the channel form and the sequence of bank deposits probably suggest a paleoflood dominance in the channel. The erosional forms developed in the earlier period also point to the impact of severe monsoon discharge, through the channel. The erosional nature of fluvial landscape and the bed forms is very striking when one considers the size of the catchment and the present discharge through the river.

The erosion and incision related to wet phase of early Holocene was responsible for the formation of terraces along the river banks.

It is also likely that the evidences of paleo floods are not preserved in the channel for a long time, but the presence of pot holes and waterfalls with deep plunge pools in the channel clearly indicates the intense fluvial activity in the earlier period. No other process can probably account for the erosional nature of the present day river channel.