

A FEW SALIENT CHARACTERS OF THE REJUVENATED NATURE OF MEJ AND ITS TRIBUTARIES ALONG THE LEFT BANK OF CHAMBAL (RAJASTHAN)

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ABSTRACT: In the sub Himalayan section, major river courses are obliterated by Himalayan orogeny and have since become rejuvenated. The Mej too, as a major left bank tributary of Chambal has undergone the same denudational processes and the present status of the river is that it has developed incised meanders, inverted topography and raised uplands at various summit levels to exhibit the various levels of rejuvenation. At first, the geomorphic cycle of the Mej Basin has been interrupted in the Cretaceous period by the Great Boundary Fault movement and later on it has subsequently been interrupted by the various phases of Himalayan orogeny. Geomorphic evidences suggest that the Mej river was in existence during the Mesozoic period. In the present paper an attempt is made to study the rejuvenated nature of Mej and its tributaries through long and cross profiles. Further, structural control over drainage pattern is also analysed.

Chambal basin, well known for its ravinous topography, has witnessed one of the recent upheavals of Himalayan orogeny and has since been rapidly incising its valley and the bed, the result of which are the deep gullies and ravines. The Mej is the major left bank tributary of the Chambal next to the Banas. Therefore, the erosional processes of Mej, have much in common with those of Chambal river and geomorphic evidences suggest that Mej was in existence during Mesozoic period.

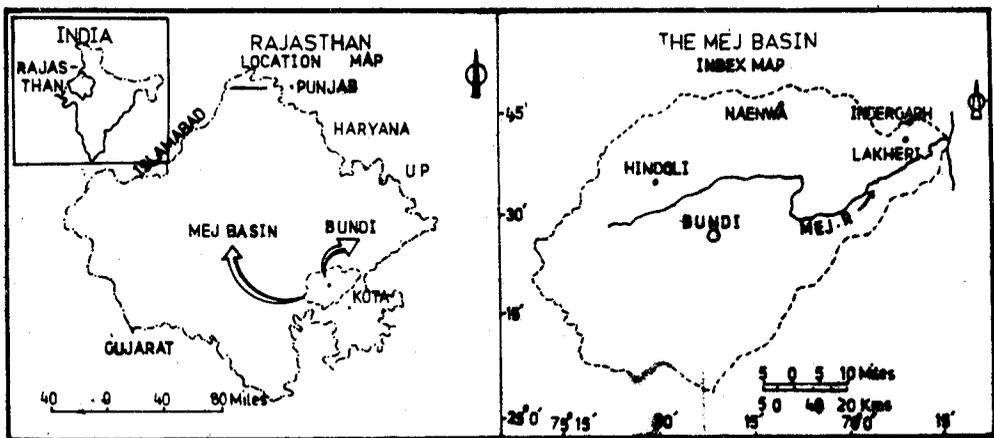
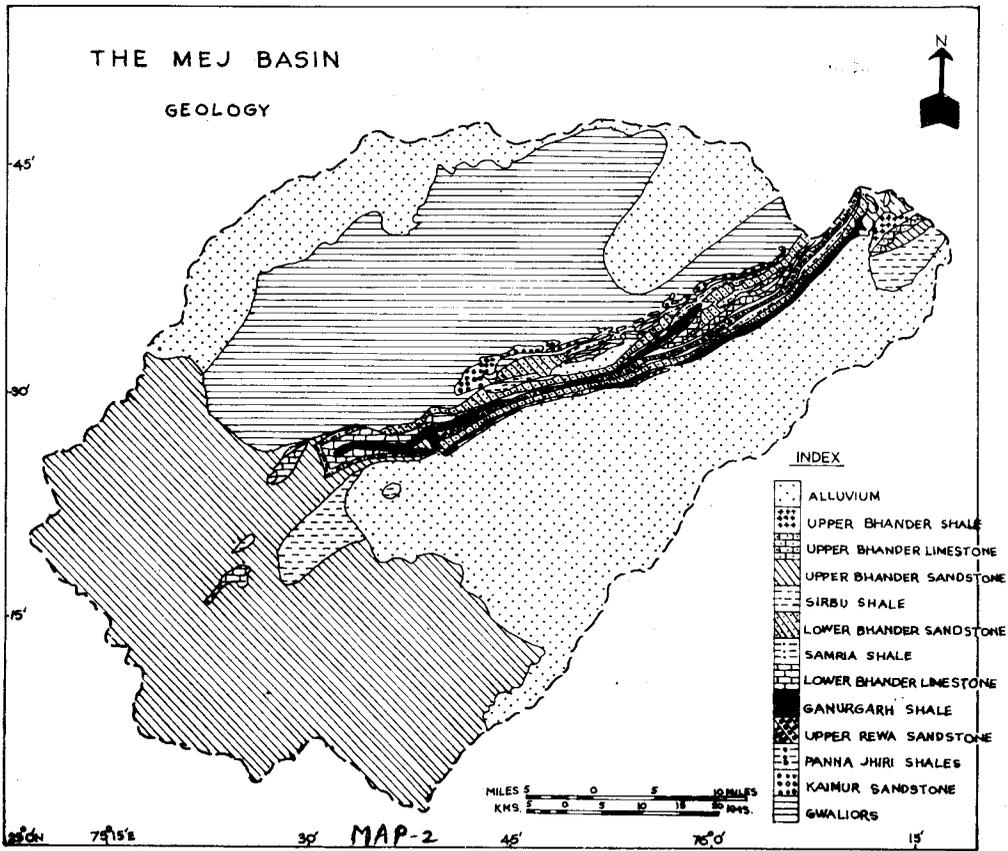
LOCATION AND METHODOLOGY:

Mej river originates at an elevation of 450 m. to the north of Tikhi village in the extreme western part of the basin. The basin is oval shaped lying between $25^{\circ}0'$ to $25^{\circ}45'$ N and $75^{\circ}30'$ to $76^{\circ}15'$ E. (Map - 1). Geologically, the Mej Basin is a transitional zone in the sense that here the younger vindhyans were folded and faulted against the older Gwalior along the Great Boundary Fault. Gwalior are formed of phyllites, shales, slates and quartzites, whereas vindhyans consist of sandstones (Kaimur, Rewa, Bhandar), shales (Ganurgarh) and limestones. Apart from these two forma-

tions, recent alluvium is also found overlying vindhyans over riverine plains (Map - 2). Major portion of the study is based on the field observation followed by mapping of long and cross profiles from Survey of India toposheets on a scale of 1 : 50,000. The drainage patterns have been picked up from aerial photographs.

FLUVIAL MORPHOLOGY:

On the basis of geomorphic features the whole course of the Mej can be divided into three sections - upper, middle and lower courses, the total length of the stream being 204.8 kms. (Map-3).

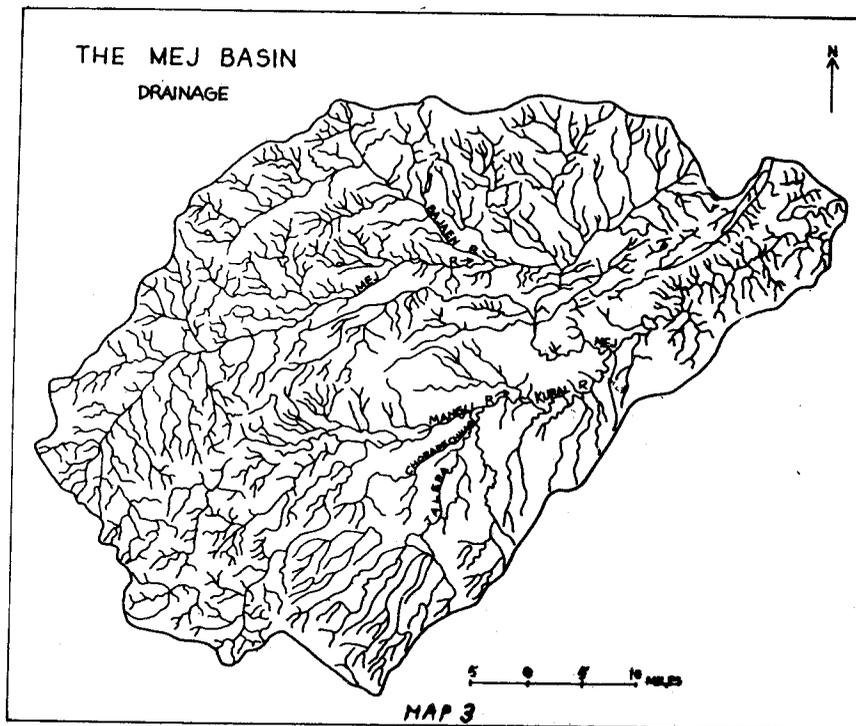


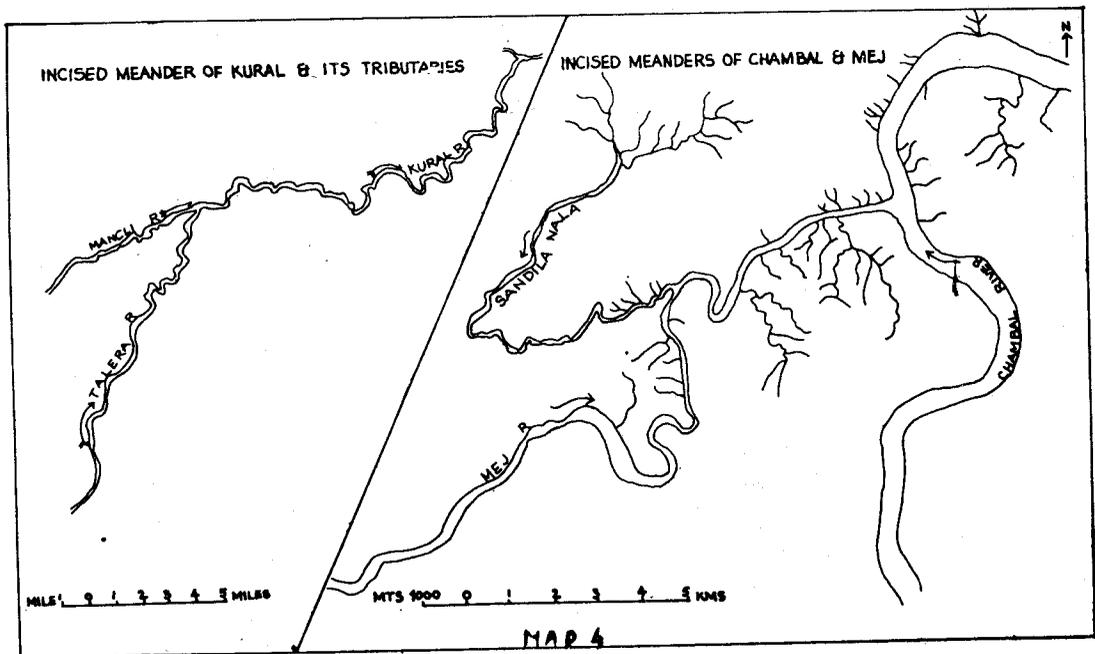
UPPER SECTION:

The whole of upper section is composed of Gwaliors and the total length of this section is 10.4 kms. On the basis of degree of dissection, the upper course is divided into two parts. The section from the point of origin to Dablana is not much dissected, but down stream from Dablana, the stream is attended by deep cut gullies and this trend continues upto Gudha. Here the bed of the river is rocky. From the cross profiles of the valley, it appears that this course is not very wide in comparison to the lower one. The course upstream Dablana is comparatively less circuitous than downstream. In this section, Mej receives a number of tributaries and it is also peculiar to note that the number of tributaries are more on left rather than on the right bank. The only single major tributary joining the Mej from right bank is Udiyan Nadi, which also carries the waters of Bundi hills.

MIDDLE SECTION:

Down stream from Gudha, the river has cut across the three successive Vindhyan ridges forming a transverse valley. This section of the river is very complicated in the sense that here the river flows in a tectonically deformed zone and the river is traversed by number of faults. At three spots, the river forms transverse gorges. South of Gudha the river cuts across Kaimur sandstone and forms a small transverse gorge then turns to the west at the base of Rewa sandstone ridge and forms a well dissected intermontane gullied zone. South of Bhimganj, it cuts across Rewa sandstone ridge and forms steep walled transverse valley and flows in a southern direction till Bara Dhundlaji - still further down, North-East of Khatkar, the river cuts across lower Bhandar sandstone and forms a steep gorge. The total length of the course of the stream in this section is 19.2 kms.





LOWER SECTION:

Down stream from Khatkar, the river enters into alluvium and forms an extensive alluvial plain. This section of the river is very important from the geomorphic point of view, as it has got two-fold significance.

The course of the Mej and its tributaries are very incised

The development of ravines and gullies in this section.

SINUOSITY INDEX:

It has been emphasized that the lower course of the Mej has been greatly incised over the flood plain. The sinuosity index of the Mej increases downstream. The average sinuosity indices were calculated for this river and its tributaries at sixteen different sites.

SI $\frac{CL}{VL}$ The values are tabulated below.

The above table shows that the sinuosity index (S.I.) of the Mej ranges between 1.3 to 2.60, the average being 1.95. The S.I. for its tributaries is 1.60 to 2.75. The values are somewhat higher for these tributaries especially in the case of sandal nala. Schumm (1963) has used a standard measure and stated that "A stream has a sinuosity of 1.0 and this number increases as the stream departs from a straight line". It is suggested that so far as flood plains do not develop, index remains at 1.0. The derived properties of the Mej and its tributaries are above 1 (one) and in some cases more than two, which itself speaks out the development of flood plains and the subsequent incision of stream courses due to recent upliftment. And secondly, the whole section of the Mej and major tributaries are attended by deep cut ravines and gullies. Both these geomorphic features of the section speak out the character of lower section. These evidences indicate that the Mej must have experienced recent

Table 1

Stream	Site	Valley length(kms)	Channel length(kms)	SI index
Mej	1	1.65	2.25	1.3
	2	1.10	1.30	1.19
	3	2.25	3.00	1.3
	4	0.75	1.85	2.45
	5	0.60	1.50	2.50
	6	1.00	2.35	2.35
	7	1.00	2.60	2.60
	8	1.19	2.12	1.95
Sandalnala	1	0.60	1.25	2.08
	2	0.75	1.35	1.80
	3	0.60	1.65	2.75
Talera	1	1.25	2.00	1.60
	2	2.75	4.50	1.64
	3	4.00	7.50	1.87
Kural	1	2.50	4.25	1.7
	2	2.75	5.00	1.8

rejuvenation and because of his phenomenon the river has entrenched its course over the sediments deposited by itself (Map - 4). The length of the lower course of the stream is 75.2 kms.

LONGITUDINAL PROFILES OF THE MEJ AND ITS TRIBUTARIES:

The study of the long profiles of the main river and its tributaries (Map - 5) throws considerable light on the evolution of this basin. The long profiles of the Mej and Manglikural show that there are two breaks in the slope of the basin. One at 300 metres and another at 240-270 metres. The former break on the Vindhya represents the nick point which once originated down stream and has migrated to this height of 300 metres indicating an upliftment of Meso-

zoic Peneplain. The latter break in the slope is on Bundi hills at an elevation between 240-270 metres. This cannot be regarded as a nick point in the Thalweg of Mej, but here the Mej has developed its valley transverse to the structure after Great Boundary Fault movement in the cretaceous period. The lower part of the profile is concave with a slight break at 225 metres indicating further incision in the lower course.

VALLEY CROSS PROFILES:

The study of the valley sites during the field investigations indicates the symmetrical nature of the valleys. The northern or left bank of the Mej river is steeper and little higher than its right bank. The general explanation for this asymmetry is the formation of undercut banks

and slip off slopes attended by incised meanders. Besides this, the exposure of the rocks on the left bank of the Mej, down stream Khatkar till Lakheri may also be a possible cause for valley asymmetry. Though these rocky outcrops are not continuous but they reappear after short intervals. Another reason for valley asymmetry of Mej in the lower section is the inclination of rocks towards north. Because of this reason, the Mej has a tendency to shift its course down the dip. This shifting course of the Mej leads again to the asymmetry of the cross profiles.

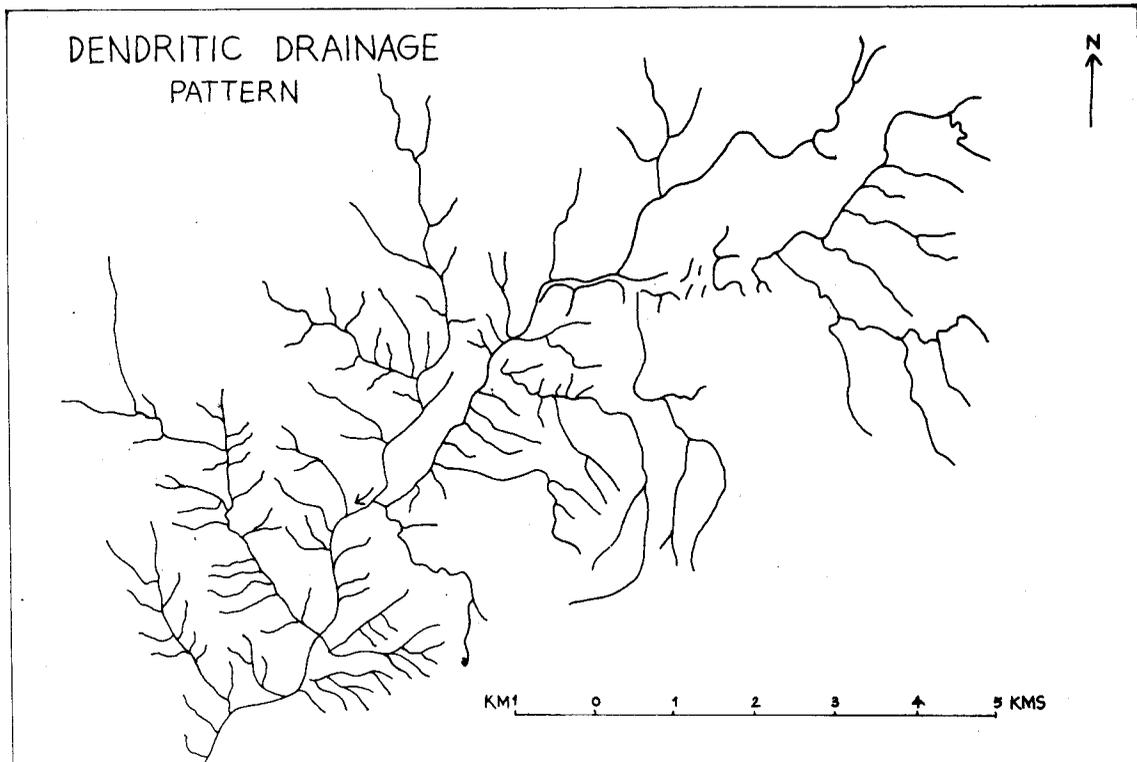
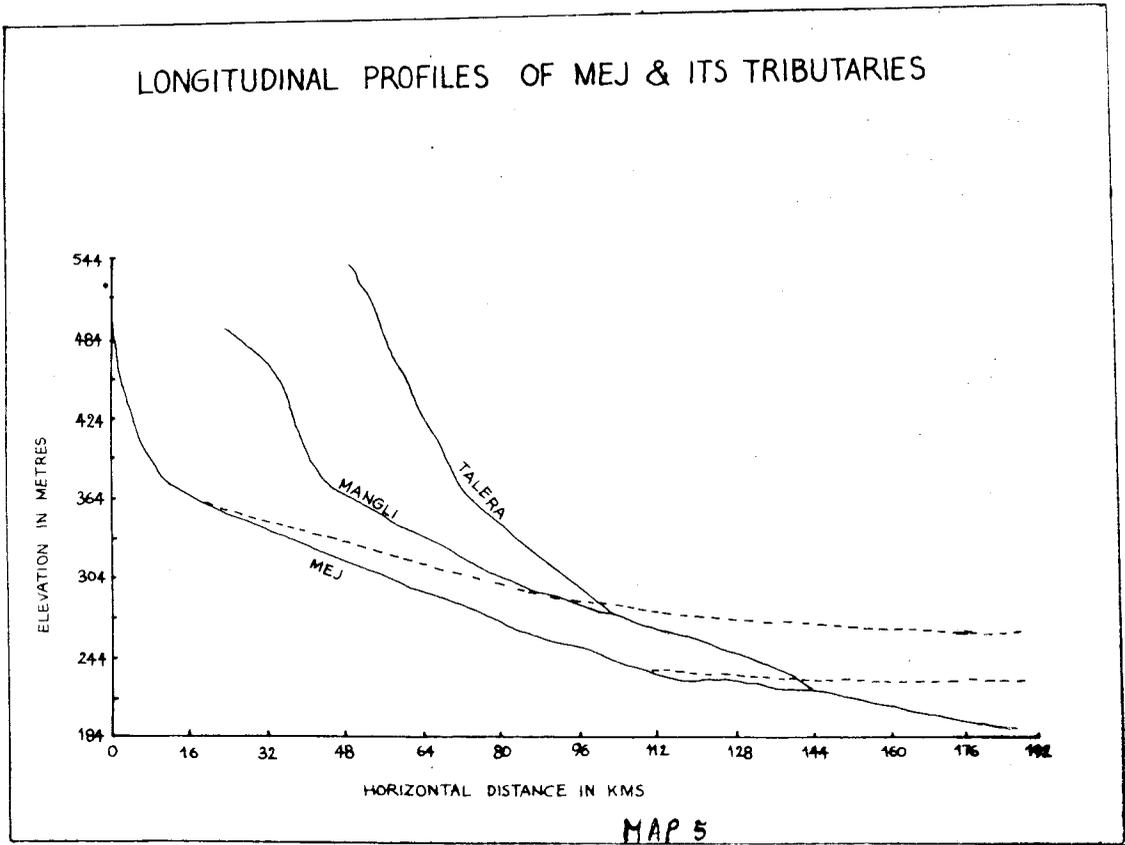
NATURE OF TRIBUTARY VALLEYS:

There are four major tributaries of the Mej river, amongst them three are left bank tributaries and one is right bank tributary. Of these rivers Kural is the major tributary of the Mej. It originates from west of Bijolia at an elevation of 525 metres. The upper section of the Kural is known as the Mangli which flows on two different rock formations of Vindhyan and alluvium. In its upper course, it flows over Vindhyan and in the lower course over alluvium. The course of Kural has deeply incised both on plateau as well as plain, the lower course being more sinuous than the upper course. There are two important tributaries of Kural - Talera and Bhimlat.

Talera also originates from South-western plateau near Nayagaon. In its major portion it flows over alluvium where it is deeply incised. Though Bhimlat is a very small tributary of the Mangli, it has considerable geomorphic importance. The study of this stream in the field has thrown considerable light on the geomorphic history of the Basin. This river is famous for its waterfall, the height of which is near about 60 metres. At this spot, the valley has a width of 60 metres. Rocks are horizontal and are of upper Bhandar sandstone. It leaves one to one's own speculation, how a small stream can cut its valley so deep on hard sandstones. It is

concluded that this waterfall has a cyclic significance which once originated downstream and has migrated to the present position. The upliftment of the south-western plateau during Cretaceous and subsequent periods has given a new power to this stream and because of this phenomenon, the Bhimlat has succeeded in cutting its course to a depth of 60 metres. The valley at the base of the waterfall is well forested. There is also noticed an abrupt change in the long profile of this stream.

Though Balandi Nadi seems like a nala over plain area, this is a left bank tributary of the Mej. The river originates north-eastern of Jahajpur hills near Bhanwar and throughout its course this river flows over Gwalior formations. Another left bank tributary of Mej is Bajaen Nadi. This river originates from Gadoli from an elevation of 450 m. This river forms a nick at a height of 300 m. between Kabri and Banoi villages. Downstream the valley is wider. The course further downstream is dissected into ravines. On the whole, the study of the Mej and its tributaries clearly shows that the newly developing streams have adjusted to the underlying geological structure. But still, there are some sites where the streams do not appear to be guided by the structure. Such features are also an evidence of upliftment in the recent past. The significant structural control of the drainage over the tectonic upliftments can be seen along the Mej. The Mej river after draining the north-western part of Bundi district near Ramgarh takes an abrupt turn towards south. This diversion of the Mej is because of the faulting parallel to the Gwalior and Vindhyan. Sharma (1969) has suggested that the Mej once might have been the tributary of Banas, and was flowing parallel to the Bundi hills towards the north-eastern direction. But its course later on is diverted by the Great Boundary Fault movement.



DRAINAGE PATTERN:

The study of the drainage pattern is an indication of the adjustment of streams with the underlying geological structure in the course of a fluvial cycle. In general, the drainage map of the Mej basin seems to be like a dendritic pattern but the close study of various parts exhibit four types of drainage patterns. Trellis, sub-parallel, Dendritic and Sub-rectangular: of these, trellis and dendritic are the most prominent.

TRELLIS PATTERN:

Trellis drainage pattern is characteristic of folded structure. This type of drainage pattern is well displayed in the Bundi-Indergarh hills (Map-6). This pattern shows a system of sub-parallel streams usually aligned with Vindhyan rocks. Alternate bands of Vindhyan sandstone and shales in this part of the basin provide favourable site for the development of this pattern. The major streams make nearby right angled bends to cross the aligned ridges and the primary tributary streams are usually at right angles to the main stream and are themselves joined at right angles by tributaries whose courses are commonly parallel to the master stream. Trellis pattern in this part of the basin reflects marked structural control of the most stream courses except the trunk stream. The tributary valleys are generally subsequent strike valleys. In this Basin, not only the folded character of the structure has provided favourable condition for the pattern, but the parallel and cross faults of this zone have also brought together alternate beds of hard sandstone and soft shales of limestone.

DENDRITIC PATTERN (MAP-7):

As has been referred above that the map of the whole basin exhibits a dendritic pattern but,

particularly to the north and south of Bundi hills, this pattern is well marked. It is generally a pattern of homogeneous structure. In the case of northern tributaries of the Mej, it appears that they generally flow over Gwalior shales giving rise to dendritic pattern. Similarly, the southern tributaries of the Mej like Kural and Talera form a system of dendritic pattern over Vindhyan sandstones and alluvium.

SUB-PARALLEL PATTERN (MAP-8):

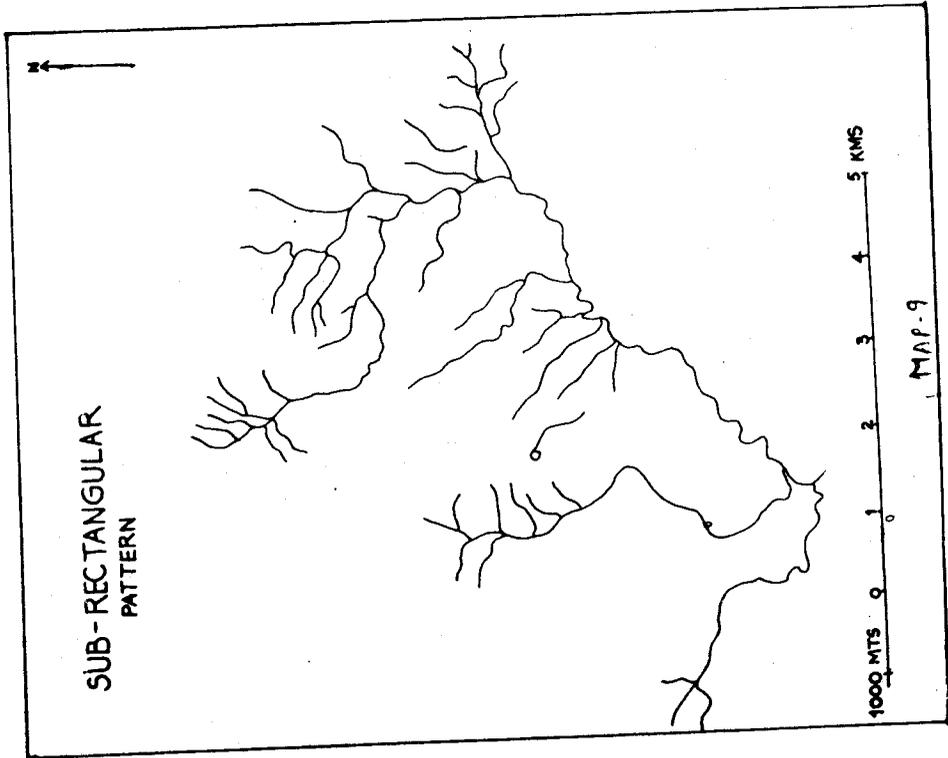
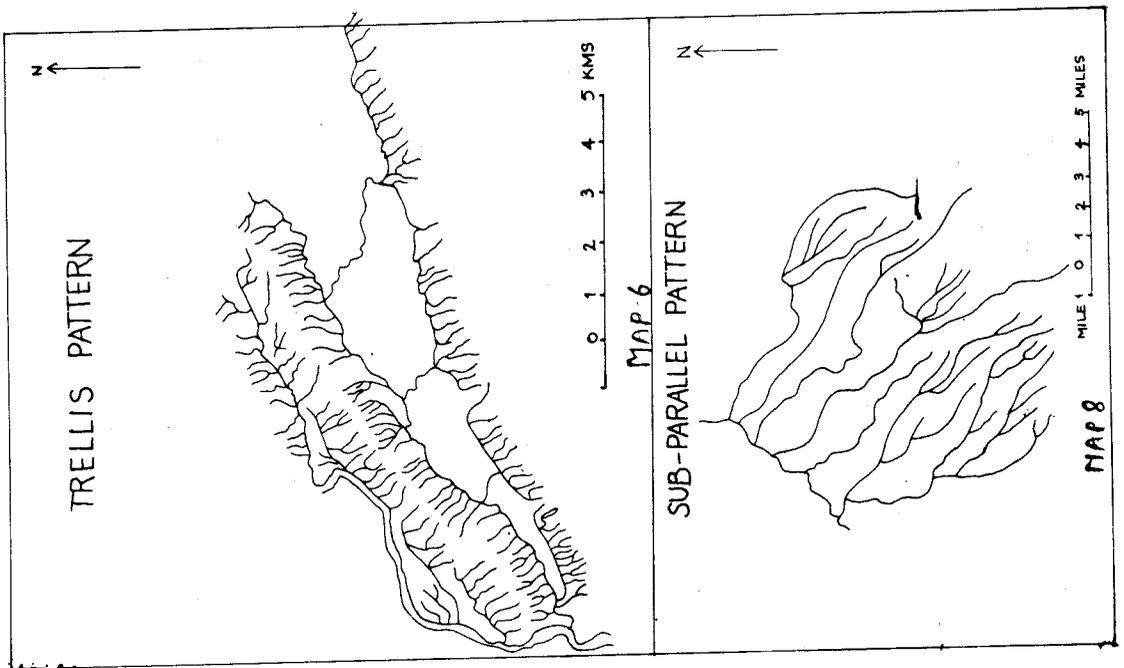
In this basin, the sub-parallel pattern is well developed over south-western plateau. Here, the tributary streams are generally sub-parallel to master stream and usually make acute angle. The underlying rocks are hard sandstones with a gentle dip of 5° towards NE.

SUB-RECTANGULAR PATTERN (MAP-9):

Sub-Rectangular Pattern is also evident in the lower part of the Mej Basin. In this part, the streams which descend from the Lakheri hill join the Mej at more or less right angles. The newly developing gullies on either side of the Mej also join the main river at right angles. The same pattern is also evidenced in the Lakheri-Indergarh hills.

On the whole, the study of the various aspects of the drainage of the Mej Basin, leads us to the following conclusions.

1. The analysis of long profiles and erosional features of Mej and its tributaries show that the Mej is a rejuvenated stream.
2. The upper course of the Mej may be considered as consequent on the Gwalior, middle course as transverse to the Vindhyan structure and lower course as a strike valley.
3. The waterfall of the Bhimlat and other tributaries very strongly reveal the fact that



- the area has been subjected to intermittent upliftments in its geomorphic history.
4. The study of drainage pattern further leads us to the idea that after the rejuvenation of the Aravallis and the Vindhyan, the newly developing streams have adjusted to the underlying geological structure thereby suggesting the advancement of fluvial cycle towards maturity.
 5. The geomorphic features of the Bundi hills clearly indicate that during Mesozoic period, the Mej was a tributary of the Banas which upholds Sharma's (1969 - 73) explanation and it can further be suggested that it is a captured river by the Chambal. The formation of wind gaps in the Bundi hills is also due to capture of streams, once flowing through them, by the headwaters of the Mej (Sharma, 1969).

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