



Recently geological study of Shivna river basin, north western region, Madhya Pradesh, India

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Abstract

This paper presents the Recently geological study; Stratigraphy, regional geology, geology of the Basin, sedimentary formation and basaltic lavas flow of the Shivna River Basin in the Deccan Basaltic Province north Western region of Madhya Pradesh, India. The geological setting of area is characterized by development of rocks of different ages, ranging from Neo Proterozoic to Recent. The presence of the Binota shale, Jiran Sandstone Kharip/ Semri Group of Vindhyan Super Group (Neo Proterozoic), and Deccan Traps (Upper Cretaceous to Lower Eocene) developed under a capping of the Laterite and Alluvium (Pleistocene to Holocene). Binota Shale is conformably overlain by grey and pink Jiran Sandstone. The ridges of sandstone are developed in North-West sector of the Basin. Deccan Traps comprise to Basaltic flows which have been grouped into Kalisindh and Kankariya – Pirukhedhi Formations. The flows have a vesicular type and sparsely to moderately porphyritic. Laterite occurs as a cover of basaltic lava flow and Alluvium deposit occurs as narrow linear belt along the River.

Keywords: stratigraphy, sedimentary, binota shale, Jiran Sandstone, Shivna River Basin, Madhya Pradesh, India

Introduction

The Shivna Basin belongs to the North-Western region of Madhya Pradesh, covering an area of 3361.52 sq. km. geologically this region is occupied by rock formations of different geological periods and bounded by the basaltic rocks of Deccan traps. The River Basin is characterized by the existence of the oldest rock unit belongs to Neo Proterozoic to Recent.

The survey of literature point out that the earliest account of the area was given by Hacket. (1881), he has mapped mainly the western part of the area, and referred the pink and grey shale of the older formation to the Aravallis but the overlying sandstone as Delhi Group. Later, Jones, (1910) mapped the northern part of the area and doubtfully correlated inliers of quartzitic sandstone near Dhorwara (24°13':75°10'; 45 P/4) and Diknio (24°10':75°05'; 45P/4) with the Aravalli Group. Roy Chowdhary (1955) correlated the shale and sandstone with the Binota shale of the Aravalli and the Jiran sandstone of the Delhi Group, respectively. The sandstone overlying the shale is similar of the other quartzitic sandstone inliers reported earlier as well as found while mapping. At a few places, these patches of conglomerate overlie the sandstone. Hence, the conformable sequence of strata consisting of shale, sandstone and conglomerate seem to belong to one formation and is uncertainly correlated with the Delhi Group.

Bhattacharjee and Munshi have carried out systematic geological mapping on 1:63,360 scales in parts of Mandsaur district, Madhya Pradesh by using toposheet nos 45P/3 & 4 as per item No. 19 of the field programme of the Geological Survey of India, for the year 1967-68.

Study Area

The present study area is located in the Shivna River Basin within the Latitudes 23° 32' to 24° 15' N and Longitudes 74° 47' E to 75° 22' E (Survey of India, Toposheet No 46 I/13 and 14, 46 M/ 1, 2 and 5, 45 L/ 16, 45 P/4, 7 and 8 on the scale of 1: 50,000, Figure -1). Shivna River originates from the Sevna village, (23° 42' 30.6" N: 74° 48' 91.4" E) at an elevation of about 524 m. in Pratapgarh District of Rajasthan, Shivna River is a main tributary of Chambal River, which extends over 103.4 km covering parts of Madhya Pradesh and Rajasthan, Shivna River Basin covers a total area of 3361.52 sq. km. The present study area constitutes a part of Malwa Plateau of the Deccan Volcanic Province. The study area is approachable both by road and rail throughout the year. The temperature ranges from 4.1°C to 45°C with an average of 24.3 °C. The minimum rainfall has been recorded as 227.30 mm and the maximum rainfall has been noted as 1441.80 mm. Annual average rainfall has been computed as 734.00 mm.

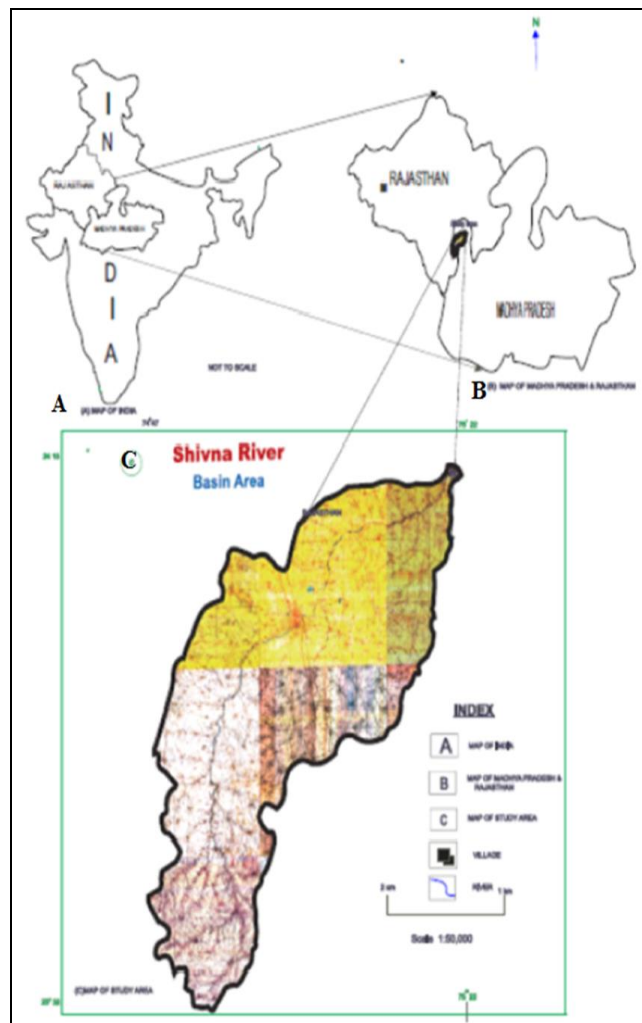


Fig 1: Location Map of Shivna River Basin, North –Western Region, Madhya Pradesh, India

Recently geological study-regional geology

Recently, Geological investigations in this region have been carried out by Geological Survey of India and Project, District Resource Map – Geology and Minerals M.P., by Khan, et al, (1992) have published geological account of Mandsaur region. The generalized geological succession of the region is displayed (Table 1).

The Binota Shale is the lower most unit of the Kharip/Semari group it comprises grey shale with thin beds of white and pink clay and is conformably overlain by grey and pink Sandstone; The Jiran Sandstone which occurs as inliers in the Deccan Trap west of Basin. Bari Shale overlies conformably the Jiran Sandstone. Quartzitic sandstone and quartzite (Kaimur Group), Shale and Sand stone (Rewa Group) shale and limestone (Bhander Group) represents the Upper Vindhya. Deccan Traps comprise to Basaltic flows which have been

grouped into Kalisindh and Kankariya – Pirukhedi Formations. The Kalisindh Formation consists of 3 ‘aa’ flows which are fine grained and non-porphyrific. The flows have a Vesicular top. The Kankariya – Pirukhedi Formation contains 5 ‘aa’ flows which are fine grained and sparsely to moderately porphyritic. The upper 2 flows are Pahoehoe type flows.

Table 1: Generalized Geological Succession of Shivna River Basin, North Western Region, Madhya Pradesh.

Period/age	Stratigraphic Status		Lithology	
Pleistocene to Holocene	Recent		Alluvium & Laterite	
Unconform				
Upper Cretaceous	Kankariya-Pirukhedi Formation	M	Deccan	5 aa and 2
To Eocene		A	Trap	pahoehoe type
		L		Basaltic flows
	Kalisindh Formation	W		3 aa type Basaltic flows
		A		
Unconformity				
Meso	Bhander Group	V		Shale and Limestone
Proterozoic	Rewa Group	I		Shale and Sandstone
	Kaimur Group	N		Panoli shale and
		D		Quartzitic Sand Stone
	Semari/	H		Suket Shale
	Kharip	Y		Nimbahera Limestone
	Group	A		Bari Shale
Neo		N		Jiran Sandstone
Proterozoic				Binota Shale

Brown ferruginous laterite capping occurs over the Vindhya and the Deccan Trap. The laterite is spongy and concretionary with small sandstone fragments and sand grains. Laterite on the Deccan traps is brownish, mottled, pisolitic, spongy and concretionary. Brown pink and grey lithomarge occurs below the hard crust of laterite.

Alluvium occurs as a narrow belt along the major river courses. it comprises grey, compact, calcareous gravel bed, Sandstone and sub angular to subrounded fragments of basalt, laterite and chert. The flood plains on the banks of the Shivna rivers comprise sand and silt.

Recently geological study-geology of basin area

Based on available information and present survey of the study area, the following stratigraphic succession has been worked out (Table 3). The geological setting of area is characterized by development of rocks of different ages, ranging from Neo Proterozoic to Recent. The characteristic features have been described in the following lines:

Table 3: Stratigraphic Succession of Shivna River Basin Area, North –Western Region, Madhya Pradesh

Period/Age	Stratigraphic status	Lithology
Pleistocene To		
Pleistocene to Holocene	Recent	Alluvium and Laterite
Unconformity		
Upper Cretaceous to Eocene	Kankariya-Pirukhedi Formation	Deccan Trap
		Basaltic Flows (5 aa and 2 Pahoehoe Types)

	Kalisindh Formation		Basaltic Flows (3 aa type)
Unconformity			
Neo Proterozoic	Semari/Kharip Group		Jiran Sandstone Binota Shale

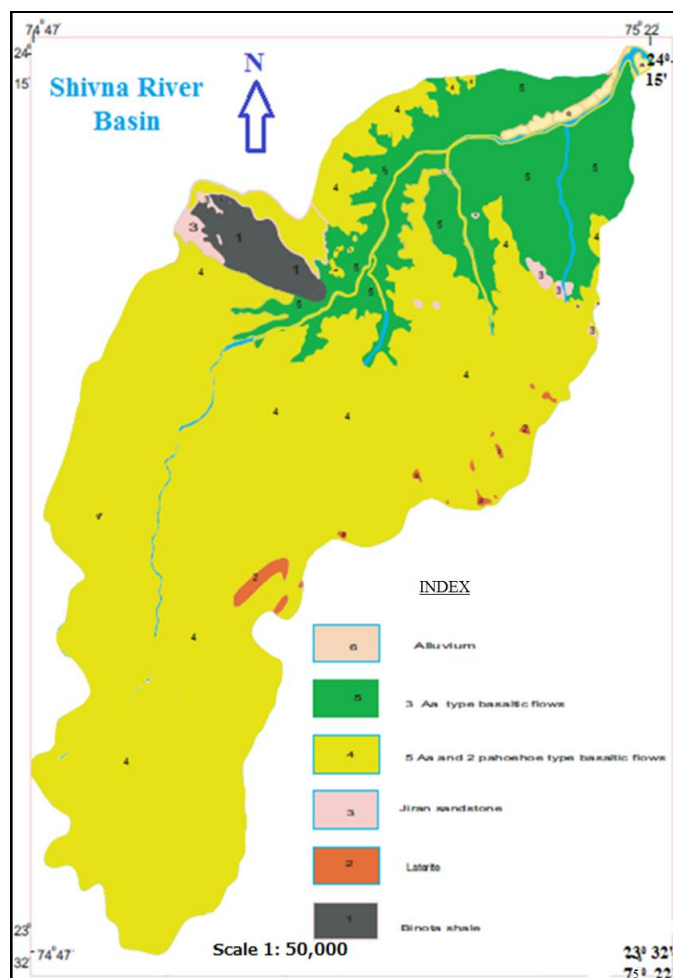


Fig 2: Geological map of Shivna River Basin, North Western Region, M. P.

Kharip/Semari Group

Kharip/Semari Group constitutes the oldest geological formation in Shivna River Basin area. It is represented by Binota shale and Jiran Sandstone, which are well developed in the North-West sector of study area.

Binota shale

Binota shale is exposed along Mandsaur – Rewas Dewar road, village Gogarpura (24° 08' N.-74° 59' E.), Pithakheri (24° 07' N.-74° 59' E.), Ghatawda (24° 05' N.-74° 58' E.), Multanpura (24° 06' N.-75° 00' E.), Bugalari (24° 04' N.-75° 00' E.) and Damdkheraat (24° 03' N.-75° 01' E.) in Basin area. The shale is grey, white to pink and soft in nature. It reveals bedding planes vertical and inclined, fine grained, near Gogarpura.

Jiran Sandstone

Binota Shale is conformably overlain by grey and pink Sandstone, which is known as the Jiran Sandstone occurring as inliers in the Deccan trap in Northwest of study Basin. The ridges of sandstone are developed in North-South-West sector

of the Basin. The Jhiran Sandstone is hard, compact, grey with purple stains, and quartzitic at few places and ferruginous in nature. The ripple marks have been observed in Jhiran Sandstone. The presence of minor inliers of sandstone within the Deccan traps is observed at Rewas-Dewara road.

Deccan Traps

Deccan Traps comprise to Basaltic flows which have been grouped into Kalisindh and Kankariya – Pirukhedi Formations. The Kalisindh Formation consist of 3 'aa' flows which are fine grained and non-porphyrific. The flows have a vesicular top. The Kankariya – Pirukhedi Formation contains 5 'aa' flows which are fine grained and sparsely to moderately porphyritic. The upper 2 flows are Pahoehoe type flows and range in age from Upper Cretaceous to Eocene age. These lava flows are characterized by the existence of spheroidal vesicles. The lava flows are mainly consist of basalts and reveal variations in texture, mineralogy and vascularity.

The important features of the flows are described in the following lines:

Lava Flow- 3 In the Basin area, the Lava Flow -3 overlies the Lava Flow -2 with a the presence of Red bole, which is visible at several places. The good exposure of flow 3 has been observed at many places including the village of Kachnara (Figure 6) and Goutamnath showing well developed joints.

Lava Flow 2. Flow - 2 overlies the Flow -.1 with a fairly sharp contact. It is yellowish brown in colour, rather medium grained and weathered. In a well section at Nahargarh inconsistent layers of clay and zeolites with thickness of about 12 cm separating the two flows. It has been observed well section at Achera (Figure 8).it has this flow has been observed at other places such as Songaria, Jagakheri and south-west of Dhabla. It is more or less identical to the vesicular part of Flow -1. The vesicular flow is overlain by a red boles band.

Lava Flow 1: This flow occurs at elevation of 416 m. (a.m.s.l.) along the Shivna River. This Flow is well exposed near Hingoria, Patan Pipliya and others places. This flow is grayish dull in colour, fine grained, vesicular and with veriable thickness.

Red Bole

It is a weathered product of lava flows,which acts as a criteria for distinction between two lava flows.In the study area Red bole helps in the identification of two different flows from each other. The Red bole reveals variation in thickness varying from 0.5 to 2.0 m.

Laterite

Laterite occurs as a cover of basaltic lava flow. It is cherry brown in colour, residual deposits of hydrated iron oxide. Laterite exposures occurs as isolated on the top of hillock namely along road of Rewas-Dewara, Botalganj and some patches in south-west Basin area. It is hard in nature and

showing well developed out crop. Laterite is now useful in brick industries.

Alluvium

The Alluvium deposit of recent age occurs as narrow linear belt along the Shivna River and its tributaries. Alluvium is characterized by fine to medium grained and admixture of fine silt and clay. The thickness of Alluvium is fairly thin in the area.

Conclusion

The Shivna River basin covering 3361.52 sq. Km in Madhya Pradesh and Rajasthan constitutes a part of Malwa Plateau, which belongs to the Deccan Volcanic Province. The regional geological setting of the Shivna River Basin exhibits the occurrence of lithounits such as the Binota shales, Jiran Sandstone (Semari Group), shale, quartzitic sandstone (Kaimur Group), basaltic lava flows with red boles (Deccan Trap Volcanic Province) and alluvium with lateritic soil (Recent). A brief illustrative account of different lithounits has been incorporated.

Geologically, the Shivna River Basin area is occupied by various rock types belonging to Vindhyan Group (Neo Proterozoic), Deccan traps (Upper Cretaceous to Lower Eocene), and

Recent sediments. The Vindhyan Group is represented by Binota Shales and Jhiran Sandstone. The Deccan Traps comprise most of the study area by different basaltic lava flows. Three types of lava flows having presence of joints, lineaments and fractures have been recognized. The alluvium and laterite of Recent age are developed along the Shivna River course.

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