NATURE OF PALAEOCURRENTS IN THE CENTRAL PART OF THE VINDHYAN BASIN

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INTRODUCTION

PALAEOCURRENT analysis is one of the major tools for working out the process and direction of transport of sediments, orientation of the basin of deposition, and the palæogeographical history of the rock units. Until the work of Banerjee and Sen Gupta (1963) this tool was neglected in the study of the Vindhyan Group, although throughout its 5,000 metres there is a variety of directional sedimentary structures. The present note is confined to the study of palæocurrent systems deducted from cross-stratification measurements in the Semri Series in Chattarpur District (M.P.), in the Kaimur Series around Gwalior, and in the Rewa Series around Sagar and Jhansi-Sagar Road.

TECHNIQUE

Trough cross-bedding, with concave fore-sets, is the normal type : planar cross-bedding is not uncommon. A succession of co-sets occurs in each section. In each co-set an azimuthal measurement was made of the maximum fore-set dip, an allowance having been made for the regional dip.

Compass-diagrams (Tanner, 1959) have been found to be more useful than the conventional rose-diagrams. The compass is divided into twelve sectors, each comprising an arc of 30 degrees. The mean of the number of measurements per sector and the standard deviation of the number of measurements per sector are calculated. If the measurements in any one sector exceed the mean *plus* the standard deviation, that sector is said to exhibit a major mode. Sectors whose measurements are below the mean *less* the standard deviation represent nodes.

PALAEOCURRENT PATTERNS

1. *Semri Series.*—The compass-diagram for 25 cross-bedding directions measured in the Semri Series exposed in the Chattarpur District (south of Bijawar) shows two modes, one north-west, one south-east (Fig. 1). These two mutually opposed modes can possibly be attributed to the fluvial currents towards the sea and on-shore directed marine currents, the fluvial currents being dominant. The stratigraphic and sedimentological studies necessary to prove this are lacking. Nevertheless, the geographical distribution of the Semri Series, coupled with the palæocurrent pattern, point to a north-east south-west orientation of the shore-line in this region, with the land source lying to the north-west. Selley (1967) noted two mutually opposed modes related to fluvial and marine currents, perpendicular to the shore-line, in the Miocene rocks of Libya.

2. *Kaimur Series.*—56 cross-bedding directions were measured on outcrops of the Kaimur Series around Gwalior. The compass-diagram (Fig. 2) shows a north-north-east and a west-south-west mode. Two minor modes in the east-south-east and the south-south-west are also noteworthy, and although these lie within one standard deviation of the mean, the occurrences in the adjacent sectors are relatively insignificant. This bi-modal palæocurrent pattern with secondary modes can possibly be related to the divergencies of the regional drainage ; a varying wind direction cannot be ruled out. As in the Semri Series, there are no other sedimentological studies to test this.

3. *Rewa Series.*—From 44 cross-bedding azimuths in the Rewa Series around the Jhansi-Sagar Road, a north-west and a south-west mode are found (Fig. 3). A secondary south-east mode is also present. 72 cross-bedding azimuths were also recorded in the same series around Sagar, and a compass-diagram of them (Fig. 4) shows two north-west modes and a south-west mode. The rose-diagram for the same 72 cross-bedding measurements (Fig. 5) (given here for comparison with the compass-diagram), gave an azimuthal mean of 274 degrees. The significance of the mean in such a case is probably questionable. Moreover, the inadequate sampling and grouping of the data of a thick rock unit may make interpretation difficult and obscure the real palæocurrent pattern. The palæocurrent pattern around Sagar might be attributed to a prodelta platform or a meandering stream system, and the Jhansi-Sagar Road pattern to a strongly meandering river, but the sedimentological

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studies to substantiate this view are lacking. A poly-modal palæocurrent pattern in the Pocono formation of Pennsylvania was noted by Pelletier (1958) and he attributed it to the divergencies of the stream system.

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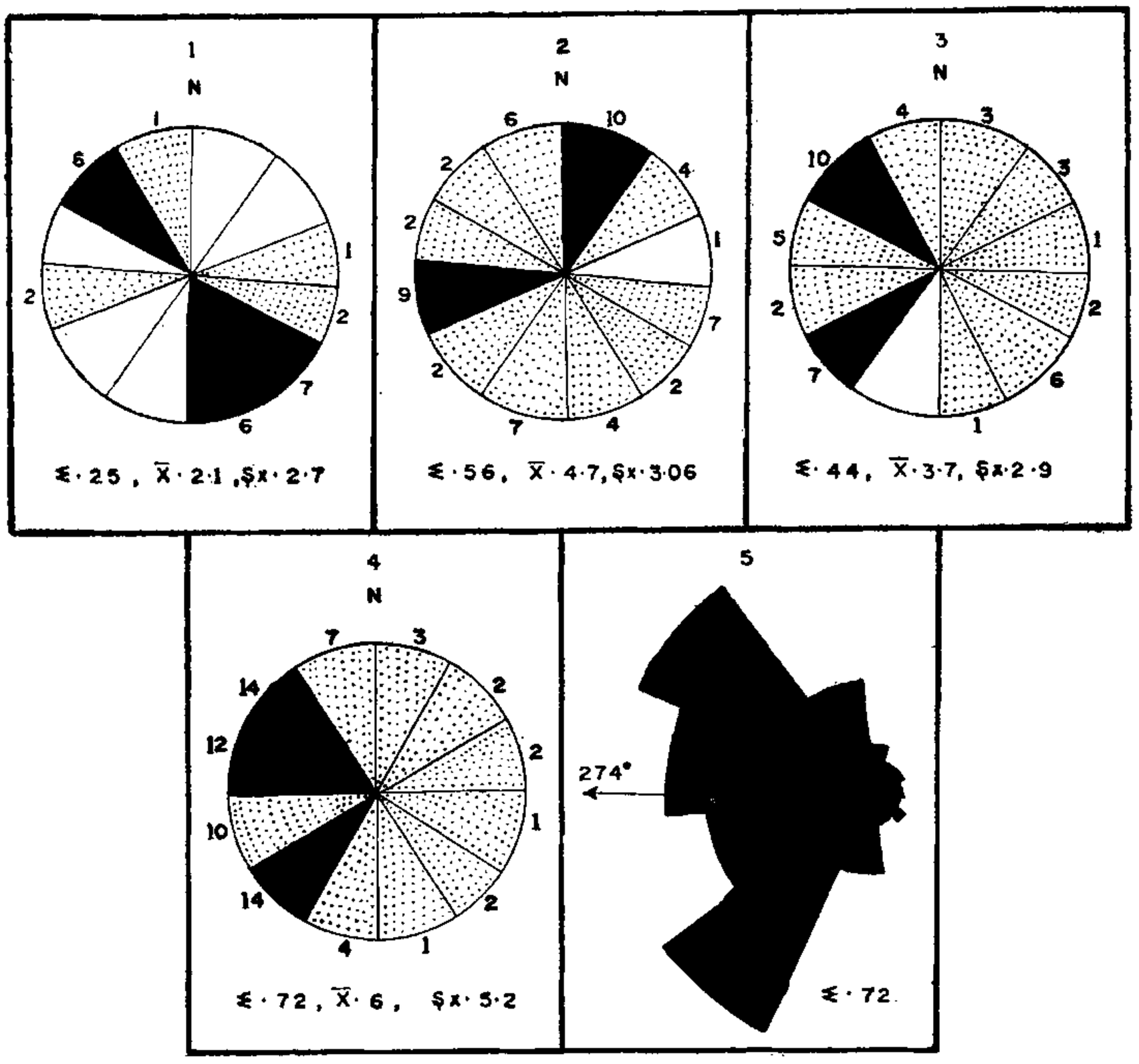

FIGS. 1–5. Compass-diagrams presenting number of measurements per 30° sector. Modes shown by shaded sectors. Sectors within one standard deviation of the mean are stippled and sectors below the difference of mean and standard deviation are left blank. Fig. 1. Compass-diagram for Semri Series in Chattarpur District. Fig. 2. Compass-diagram for Kaimur Series around Gwalior. Fig. 3. Compass-diagram for Rewa Series around Jhansi-Sagar Road. Fig. 4. Compass-diagram for Rewa Series around Sagar. Fig. 5. Rose-diagram for Rewa Series around Sagar.

On the basis of the data presented in this note and an analysis of the data of Mishra (1967) on the south-western part of the basin, and of Jafar *et al.* (1966) for Fatehpur Sikri (Agra), it is evident that the provenance shifted from the north-west during Semri deposition towards an east to south-west range of directions during the Upper Vindhyan, although the data are still not sufficient to be certain. If true, the orientation and the position of the basin must also have changed.

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