Chapter V

PALAEOMAGNETIC STUDIES

It is now well established that certain types of rocks acquire during their formation a permanent magnetisation in the direction of the earth’s magnetic field prevailing at that time. As this magnetisation has been shown to be very stable these rocks preserve a reliable record of the earth’s magnetic field during the period of their formation. Measurements of magnetic directions of such rocks formed at different times in different continents have provided valuable data having a direct bearing on larger geophysical problems such as continental drift, polar wandering, reversals of the earth’s magnetic field in the geological past etc and have also proved useful in tackling many other geological problems.

The Deccan Trap basalts because of their strong magnetisation and high magnetic stability were among the first rocks in India to be studied palaeomagnetically. As the early studies (Clegg et al 1956, Deutsch et al
1959) indicated that the earth's field had undergone a reversal during the Deccan Trap period, and also that India was south of the equator during the Deccan Trap period, and has drifted northward since then, it was felt that palaeomagnetic studies could perhaps help in determining the relative ages of the dykes.

This was discussed, as stated earlier, first with Prof. Blackett and then with Dr. Clegg, and finally it was decided that palaeomagnetic work should be carried out in collaboration with Drs. P.W. Sahasrabuddhe and C.R.K. Moorty of the Tata Institute of Fundamental Research, Bombay, who were doing palaeomagnetic work on the Deccan Trap basalts. Accordingly, a number of field trips were made with them for collecting oriented samples of dykes and country rocks for palaeomagnetic studies and also for taking magnetic traverses in the basalts. During these trips oriented samples of some selected dykes in the Karjat-Neral area and also from Alandi near Poona were collected for detailed palaeomagnetic studies (Sahasrabuddhe, 1963). Later, magnetic traverses across a number of dykes described here were carried out with them, for determining the
sense of magnetisation of the dykes (whether normal or reverse) with a hand magnetometer. As these studies gave some significant results they are being presented here.

Before stating the results it is necessary to state with what expectations the palaeomagnetic work was undertaken.

As already stated, early work on the Deccan Trap rocks had indicated a drift of India from South of equator to its present position. It was therefore thought that the ancient latitude of a flow or dyke calculated from its directions of magnetisation could indicate its relative age, as successively younger rocks would give progressively more and more northerly latitudes. However, results obtained from various sequences of Deccan Trap flows studied by Sahasrabuddhe (1963) at different localities, including the 1200 feet thick sequence at Mahabaleshwar consisting of 30 flows, did not show consistently the expected trend in the change of magnetic directions of flows taken in ascending order, and therefore, latitudes calculated from these could not be taken as indicators of stratigraphic position of flows. Sahasrabuddhe (1963)
attributes these erratic changes to secular variations in the earth's magnetic field and as because of them reliable latitude determinations are not possible, detailed magnetic studies of the dykes were not undertaken after the first studies by Sahasrabuddhe (1963), the results of which are reproduced in Table XIII.

Table XIII
Mean magnetic directions for the dykes around Neral and Karjat (Lat. 18° 57' Long. 73° 19')
(Sahasrabuddhe 1963)

<table>
<thead>
<tr>
<th>Dyke no.</th>
<th>Number of Samples</th>
<th>Number of Specimens</th>
<th>Mean Direction Azimuth E of N</th>
<th>Dip -ve(up)</th>
<th>Polarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>3</td>
<td>9</td>
<td>148</td>
<td>+ 50</td>
<td>R</td>
</tr>
<tr>
<td>111</td>
<td>6</td>
<td>18</td>
<td>135</td>
<td>+ 61</td>
<td>R</td>
</tr>
<tr>
<td>118</td>
<td>2</td>
<td>5</td>
<td>130</td>
<td>+ 13</td>
<td>R</td>
</tr>
<tr>
<td>121</td>
<td>2</td>
<td>5</td>
<td>132</td>
<td>+ 28</td>
<td>R</td>
</tr>
<tr>
<td>140</td>
<td>9</td>
<td>31</td>
<td>141</td>
<td>+ 39</td>
<td>R</td>
</tr>
<tr>
<td>Local traps at Karjat</td>
<td>3</td>
<td>12</td>
<td>148</td>
<td>+ 40</td>
<td>R</td>
</tr>
</tbody>
</table>
Sahasrabuddhe (1963) had found in all Deccan Trap sequences studied by him that with the exception of Bombay, flows up to about 2000' above sea level were reversely magnetised and those above were normally magnetised. As the reverse traps, even after extensive studies, have not been found to possess any magnetic self reversing property it may be concluded that the earth's field was in a direction opposite to that of the present field at the beginning of the Deccan Trap period and became normal after the eruption of the flows we find today at about 2000 feet above sea level (Sahasrabuddhe 1963). This again provides a criterion for determining relative ages of the dykes, the older ones being reversely and the younger ones normally magnetised. As this was found to be quite reliable, subsequent studies were restricted to determining the sense of magnetisation of suitable dykes.

In the Karjat Group, Dyke Nos. 105, 117, 124 and 160 were found to be normally magnetised while Dyke Nos. 118, 121, 122, 123 and 172 to be reversely magnetised.

In the Neral Group, Dyke Nos. 108, 110, 111, 137, 139, 140, 141 and 173 were all found to be reversely magnetised.
In the Badlapur Group Dyke Nos. 126, 127, 129, 146, 147, 155 and 157 were found to be reversely magnetised.

References