SYNOPSIS

This thesis embodies a detailed account of paleomagnetic and chemical studies carried out on some of the dykes in the Mysore State. In the last decade the integrated studies have been a fascinating field on account of its successful application in solving many of the complex problems of geosciences. The study includes paleomagnetism of ninety-one samples (370) specimens and major elements of thirty-seven samples from ten different dykes.

The preliminary investigations carried out on the natural remanent magnetization (NRM) of these dykes revealed large scatter from dykes 1, 2, 4, 5, 6, 7, 8, 9 and 10, whereas the directions from dyke 3 are clustered. On successive cleaning by a.c. demagnetization with the peak field values up to 300 oersteds on the specimens from all the dykes show that the scatter has been reduced in six dykes (1, 2, 5, 6, 7 and 10) and revealed consistent directions. However, the scattering in the four dykes (3, 4, 8 and 9) remained unchanged.

It has been shown by a.c. demagnetization curves that out of ten dykes studied, four dykes (3, 4, 8 and 9) did not improve after cleaning, thereby indicating that the original thermo-remanent magnetization (TRM) was destroyed to a large extent. Whereas, the directions of six dykes (1, 2, 5, 6, 7 and 10) form a cluster away from the present geomagnetic field.
At least two specimens from each of the six dykes showing consistent directions were heated up to Curie point to see the thermal stability and it was observed that within the limits of experimental error they remained in the group which was formed by the a.c. demagnetization. This suggest that natural remanent magnetization (NRM) in these dykes is of thermo-remanent magnetization origin. The Curie point values range from 280 to 480°C for all the dykes.

Remanence coercivities have been measured for a few specimens from each dyke by magnetizing them in a maximum field strength of 1500 oersteds and subsequently demagnetizing. The values of the remanence coercivity was found to be low and within the range of 150 to 300 oersteds. Titanomagnetite is the only iron-oxide which is known to have coercive force of this order.

Thermal behaviour studies have been made by heating few specimens from each dyke to higher temperatures for studying the decay of Jn and then cooled in the earths magnetic field to room temperature to produce Jt (total TRM). It has been observed that in most of the cases about 50% of Jn is demagnetized or 50% of Jt is acquired at a temperature between 300 to 400°C. A close resemblance of Jn and Jt curves also suggests that the NRM possessed by these dykes is of TRM nature.

Few polished specimens have been examined from each dyke which show chiefly titanomagnetite (Fe$_2$-TiO$_4$.Fe$_3$O$_4$ solid solution).
All specimens have lamellae of ilmenite and are oriented in (111) plane of magnetite. The dykes which show high magnetic stability also show high temperature oxidation effects and single Curie point. Whereas, the unstable dykes show two or more Curie points and low temperature oxidation.

The low Curie points, as shown by all the specimens, correspond to titanium rich titanomagnetites or low grade titano-maghemite thereby substantiating the conclusion that titanomagnetite is the main carrier of remanent magnetization.

The virtual geomagnetic pole positions have been derived from the mean directions of RM for six dykes. The poles derived from dykes 1, 5 and 6, are close to each other. This suggests that these dykes might have intruded contemporaneously. The poles of these dykes and dyke 7 are in broad agreement with mean pole positions of upper and lower Deccan traps. This suggests that these dykes are of much younger in age, probably contemporaneous to Deccan trap igneous activity. The poles from dykes 2 and 10 fix the position of India in the northern hemisphere thereby suggesting their probable Precambrian age.

The chemical composition shows that the dykes 2, 4 and 10 are alkalic in nature, characterised by high alkalis, titanium and low silica whereas dykes 1, 3, 5, 6, 7, 8 and 9 belong to tholeiitic type as they are rich in silica and poor in titanium. The tholeiite dykes show a remarkable similarity with the petrochemistry of Deccan traps.
The dykes of the Indian shield under study can be divided into two periods: (a) alkali basalt dykes of probable Precambrian age; (b) tholeiite basalt dykes of Deccan trap age (Upper Cretaceous–Eocene).

The above conclusions are drawn by making use of the combined geophysical and geochemical studies.