

Geomagnetic Deep Sounding of Southwestern Nigeria.

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Abstract:

Five modified version of Gough-Reitzel's magnetometers were operated between December 1985 and March 1986 at five locations: Ibadan (IBD), Ile-Ife (IFE), Ise-Ekiti (ISE), Igbile (IGB) and Okitipupa (OKT). The magnetometer array experiment was to aid the study of the magnetic field variations of part of south-western Nigeria, and to deduce the general geologic nature of the subsurface in this area. Five night-time and two day-time disturbance events selected from the suite of observed magneto grams were used in the analysis. To process the magnetic data a home-made digitizer was contrived and spectral analysis computer soft-ware programs were developed and implemented on a TRS-80 Radio Shack micro-computer system. Features of the computer package are described in details in the thesis.

Magneto grams of the day-time events exhibit large amplitude north-south horizontal component (H) with enhanced vertical field (Z) at IBD. The H-field also decreases toward the coastal stations from IBD. These are indicative of the spatial non-uniformity in the equatorial source field. In all the night events, the spatial uniformity of the source field over the area of study is obvious from both magneto grams and the plot of the amplitude of the Fourier spectra for H and D components for all the stations. The coherence plots with IFE as reference station also confirm the uniformity of the source field. Both magneto grams and the plot of spectra amplitude also show strong correlations of the Z-field with the H-field and none with the D-field. The Z-field also diminishes inland. This is a clear exhibition of coast effect.

Plots of Z/H at selected peak periods were made with H defining the horizontal field component which shows maximum correlation with Z-field component. Values of Z/H at the period of 60min. when interpreted with similar curves by White and Polatako (1978) show that the rate of decrease of the coast effect inland is more rapid than what Everett and Hyndman (1967) proposed for the shield region of Australia. A possible explanation could be the presence of a transitional region between the shield and the ocean. Similar results were obtained for South Australia by White and Polatako (ibid).

Plots of induction arrows at 42min. period at all the stations point to the 500m fathom line, indicating current concentration in the deep ocean adjoining the coast. Arrows at period of 25min. however point westward at IFE. This could be due to additional inland anomaly. A two layered earth model attempted for observed data for IFE showed depth to increased conductivity as 340km. This is contrary to earlier models which obtained depth to ultimate conducting layer as less than 100km which gives erroneous impression of on-going tectonic processes in this area. To infer the detail features of geologic structure in the area from obtained data, a programme of stripping the coast effect which is the dominant anomaly recorded suggested for further studies.

Keywords: Gough-Reitzel's magnetometer/ magnetometer

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