At shorter periods local induction in the waters of Cook Strait still affects sites close to the Strait but at distances of around 60 km away variations can be quite well modelled by two-dimensional structure.

Other magnetovariational results are the identification of conductivity anomalies across the Wellington region and further north close to Mounts Egmont and Ruapehu. The former is supported by preliminary magnetotelluric measurements in the region (Ingham 1985b) which show a large conductivity contrast possibly associated with one of the major faults in the region. The latter anomaly may be linked with a known region of attenuation of high frequency seismic waves and is also under investigation using magnetotelluric sounding.

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Geomagnetic deep sounding of Java Trench subduction zone

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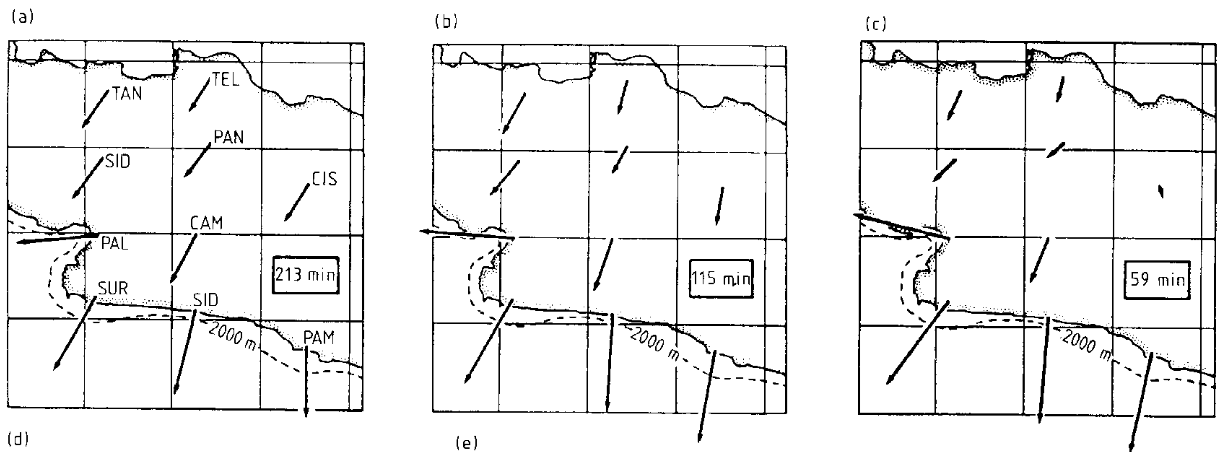
Due to the complex tectonic setting of an island arc subduction zone, which involves marked changes in temperature and lithologies at depth, one might expect subduction zones to be associated with significant geomagnetic deep sounding (GDS) anomalies. This is the case in Japan and in Peru. In both cases the heat rising above the descending slab and the resistive upper part of the slab have been suggested as possible causes for the observed anomalies. Jones *et al.* (1981) showed that the temperature distribution could be significant, and presented the GDS anomaly for three different thermal models.

In 1981 12 magnetometers of the type described by Chamalaun and Walker (1982) were deployed for 9 weeks in western Java, to determine the GDS signal associated with the classical subduction zone of the Java Trench. The induction arrows (Fig. 1) are directed towards the coast, and



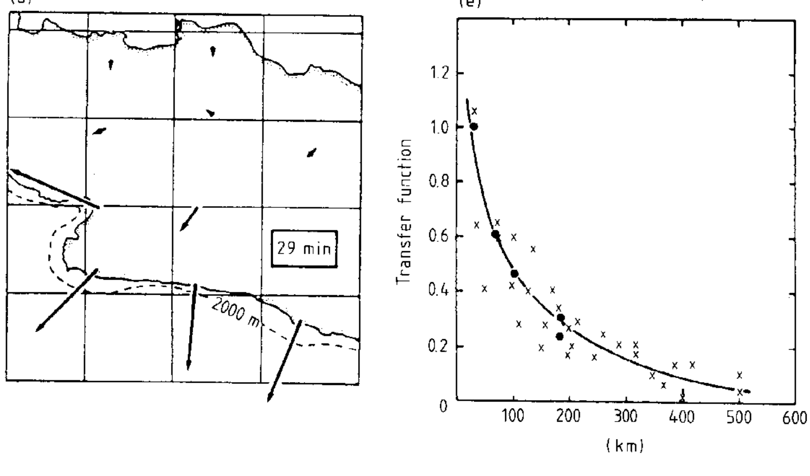


Fig 1 Induction arrows determined from measurements of magnetic fluctuations made on Java. (a-d) Induction vectors for selected periods. (e) Landward decay of the transfer function (●) cf. results from young tectonic terraces in Australia and California (x) (Parkinson & Jones 1979).

at 1 h periods decrease in length from about 1.0 at the coast to 0.2, 130 km inland. Little evidence was found for near surface conductors, such as might be associated with currently active volcanoes.

If the transfer functions are plotted as a function of distance from the coast, using the 2000 m bathymetry contour (rather than the trench) as origin, the decay is found to be indistinguishable from that found at 'young tectonic' continental margins, such as those in California (Schmucker 1970), the east (Bennett & Lilley 1974) and south coast of Australia (White & Polatajko 1978). A similar normal coast effect was observed by Aldrich (1972) for the southern portion of the Peru-Chile trench in Chile.

From the west Java and Chile results it would appear that neither the expected temperature contrasts, nor the presence of a more resistive upper slab, are by themselves necessarily sufficient to modify the normal coast effect.

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Conductive structures under the Canadian Cordillera

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Three major structures of high electrical conductance have been mapped and investigated by means of large arrays of three-component recording magnetometers. The first array was deployed during 1980 and covered an area of 500 000 km^2 at a station spacing of about 150 km, with correspondingly low resolution. This array served to locate anomalies in the magnetovariation fields, two of which were mapped and studied by means of arrays with stations 50 km apart, each covering about 50 000 km^2, during 1981. These are denoted the 1981A and 1981B arrays.

The 'discovery' array of 1980 gave preliminary maps of three structures, all detected previously with linear arrays of magnetometers. A large regional conductive layer, in the upper mantle and lower crust, covers much of the Cordillera of Canada south-west of the Rocky Mountains tectonic province, where it attenuates the vertical component of magnetovariation fields. Figure 1 illustrates this attenuation at a period of 25 min. This conductive layer is called the Canadian Cordilleran Regional (CCR) conductor. Its conductance is of the order of 10^4 S.

The CCR conductor is bounded along its north-eastern edge by the pre-Mesozoic craton of North America. Near that edge the conductor thickens and produces large local anomalies in all three components of the fields, in the Rocky Mountain Trench near latitude 53°N. Two stations of the 1980 array detected this anomaly, but could not define its shape; it appears near the centre of the northern-most line of stations in Fig. 2.

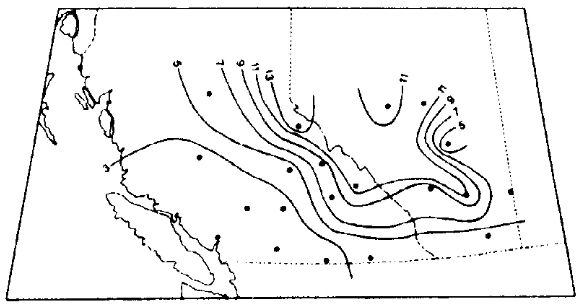

Fig 1 Fourier transform amplitude at period 25 min of the vertical component, Z, of a magnetovariation event recorded by the 1980 array (Gough *et al.* 1982).

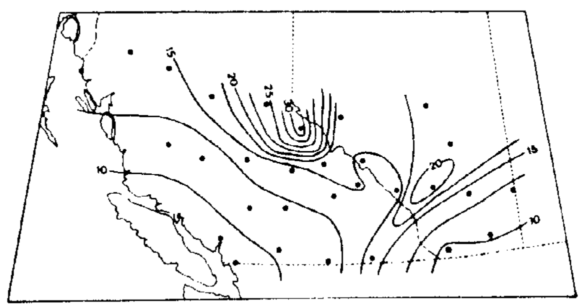

Fig 2 Fourier transform amplitude at period 15.5 min of the north-south horizontal component, X, of a magnetovariation event recorded by the 1980 array (Gough *et al.* 1982).