Professor Dosso and Dr Nienaber of the University of Victoria, British Columbia, have made a physical model in which the induction in sea water is simulated for Tasmania with its surrounding oceans and Bass Strait (Dosso *et al.* 1985). This has enabled us to evaluate, and to a certain extent compensate for, the effects of the oceans.

A striking feature of the anomaly is that it extends a great distance to the west. The influence is clearly visible at Bronte Park, in the centre of the island. It appears to be wider in the north where its western limb may curve to the west passing under Deloraine and Mole Creek. However, because of the effect of Bass Strait, this is difficult to verify. However, along most of its length it is sufficiently close to a two-dimensional structure to be modelled as such. The Jones and Pascoe program was used to search for models that approximated the field results. Two magnetotelluric studies carried out by Bindoff (1983) and Sayers (1984) show that the conducting body is shallow and very conductive, (i.e. a depth of 2 km and a conductivity of between 1 and 2 S m^{-1}). Using these restraints the best fitting models consist of a rather thin (3 km thick) highly conducting (2 S m^{-1}) body either dipping or tapering to the west and with a total width of about 30 km in the centre and up to 70 km further north.

Some geologists (e.g. Powell 1984), consider that the Tamar Lineament is part of what has been called the 'Tasman Line', which consists of rifts and transform faults. It runs from near Cairns through the Flinders Ranges, then via a transform fault (the 'Gambier-Beaconsfield fracture') to Bass Strait and thence southward as the Tamar Fracture Zone. It is considered to represent the eastern margin of the Australian continent in Cambrian times. An interesting feature of this concept is that practically all the important conductivity anomalies found in Australia lie on or near this Tasman Line.

It is not easy to identify the cause of the high conductivity associated with the Tamar anomaly. The presence of semiconductors, except possibly graphite, is precluded by the absence of a significant magnetic anomaly coinciding with the conductivity anomaly. The shallow depth makes the presence of graphite unlikely and a sufficiently high temperature is out of the question. The most likely cause seems to be fractured rock saturated with highly conducting fluids. Archie's Law suggests that a porosity of 20–40% is necessary with a fluid conductivity of the order of 10 S m^{-1}. Fluids with such a high conductivity have been reported, but are generally confined to oilfields.

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Geomagnetic induction studies in central New Zealand

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A series of magnetovariational and magnetotelluric studies are currently under way in central New Zealand. These include:

(1) A magnetovariational study of the lower part of the North Island.

(2) An investigation into the channelling of induced currents through Cook Strait.

(3) A magnetotelluric traverse across the Wellington region.

(4) A magnetotelluric investigation of a known seismic boundary in the Egmont-Ruapehu region.

The magnetovariational results obtained to date (Ingham 1985a) indicate that at periods of 3000 s and above the main factor affecting geomagnetic variations on the north side of Cook Strait is the presence of induced currents in the Pacific Ocean. However, there is evidence of the channelling of these currents through the Strait. This has been clearly demonstrated by Boteler *et al.* (1985) by means of simultaneous measurements of the magnetic field on either side of the Strait and the voltage in a cable across the Strait (Fig. 1).

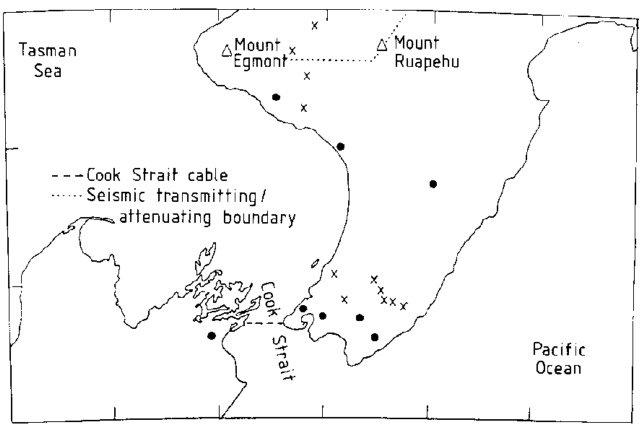

Fig 1 Map for geomagnetic induction studies in central New Zealand. • denotes magnetovariational site for geomagnetic depth sounding (GDS). x denotes the site for magnetotelluric sounding and GDS.

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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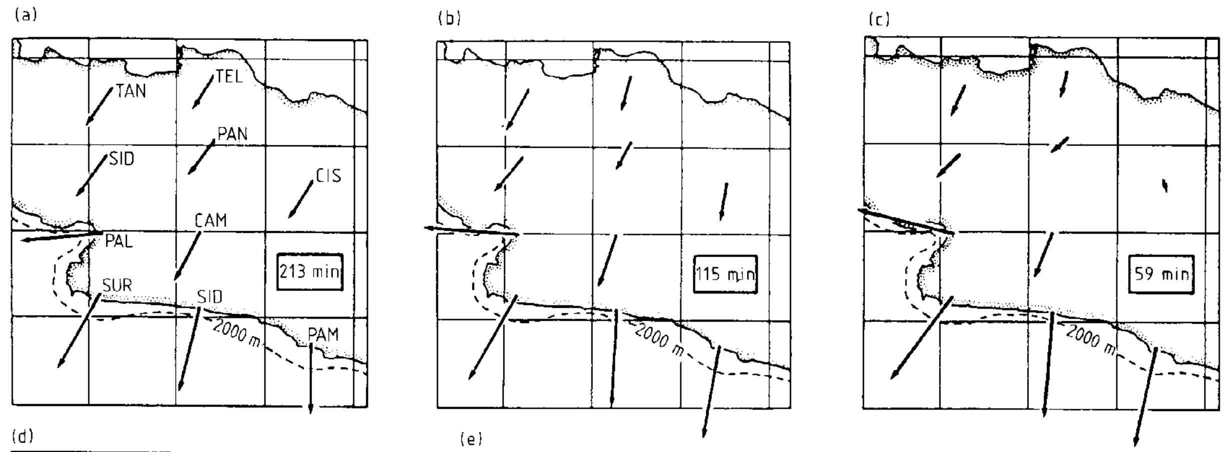
Due to the complex tectonic setting of an island arc subduction zone, which involves marked changes in temperature and lithologies at depth, one might expect subduction zones to be associated with significant geomagnetic deep sounding (GDS) anomalies. This is the case in Japan and in Peru. In both cases 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



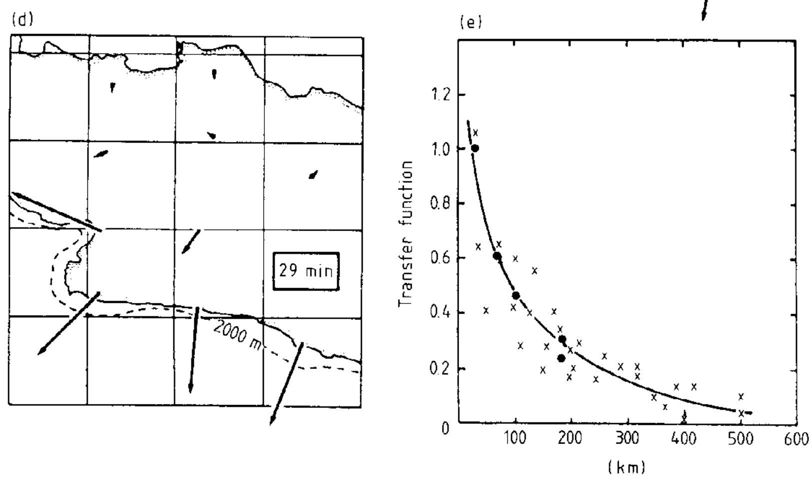


Fig 1 Induction arrows determined from measurements of magnetic fluctuations made on Java. (a-d) Induction vectors for selected periods. (e) Landward decay of the transfer function (•) cf. results from young tectonic terraces in Australia and California (x) (Parkinson & Jones 1979).