high Ba and Ga/Al and low Sn characteristics of the Jervois Suite, of which they are a westward continuation. Though poorly constrained by age determinations, present data suggest that the Jervois Suite was emplaced ca 1750 Ma.

A newly recognised suite of enriched felsic rocks, the Madderns Yard Suite (Fig. 16), occurs in the Southern Province in the west. It includes the Madderns Yard Granite, comprising large dykes and small bosses of fine-grained leucogranite intruding deformed and migmatised volcanics; the Teapot Granite near Mount Zeli; granite base- dated as 1660 Ma (Table 1) east of Glen Helen homestead; and probable fine-grained metavolcanics from west of Papunya, in adjacent MOUNT LEIBIG. The suite has low Sn, and high Ba, similar to the Jervois and Kintore Suites to the east and west. High REE, Th, and U are contained in allanite; monazite is less common.

The few analyses of felsic rocks from north of the RTZ do not fit the patterns seen south of the RTZ (e.g., Fig. 17), and confirm field observations that some are plagioclase granites. Some of the felsic rocks appear to have a sedimentary component (Fig. 18). No granite of the flat-profile type has yet been recognised in HERMANNSBURG.

**Economic implications**

Enriched granites, such as those in the Madderns Yard Suite, are the probable source for the uranium deposits in the Late Devonian sedimentary rocks of the Ngalia and Amadeus Basins, and potential sources for uranium deposits in Tertiary and Quaternary sediments. Drainage from the Madderns Yard Suite into the Dashwood and Derwent River systems flows out in the northwest of HERMANNSBURG; abandoned drainage channels indicate that the flood-out water previously reached the salinas south of the Hann Range. If, as appears probable, the water moves into closed groundwater basins in this region, then these may be trapping uranium extracted from the Madderns Yard Suite.

For further information, contact Dr Gladys Warren (Minerals & Land Use Program) at BMR

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**AWAGS — towards an 'aeromagnetic risk' map of Australia, and a basis for regional magnetic field surveys**

Fifty-seven recording stations comprising the Australia-Wide Array of Geomagnetic Stations (AWAGS) were used to record natural variations of the geomagnetic field at one-minute intervals between November 1989 and July 1990. Preliminary results are giving unprecedented insight into the large-scale magnetic induction properties of the crust (reflecting its subsurface electrical conductivity structure), and the effect this has on the accuracy of base-stations used for correcting aeromagnetic surveys. AWAGS is also giving us a more detailed picture of the diurnal pattern of field variations over Australia than has hitherto been possible. Several airborne and satellite survey activities are taking advantage of this for mapping the regional magnetic field over the continent.

Aeromagnetic surveyors must contend with the temporal (diurnal) variations of the geomagnetic field, and the complications arising from the heterogeneous nature of crustal induction effects that distort the diurnal variation on a local as well as a regional scale.

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April 1991

BMR Research Newsletter 14

achieve complete seasonal information about undisturbed diurnal (Sq) patterns of geomagnetic variation.

Design and development of the magnetometers was carried out at Flinders University. Each instrument package is completely self-contained, and comprises an orthogonal set of three Kelvin-Hughes fluxgates, control electronics, a solid-state memory card for logging the data, and a battery pack. The magnetometer is housed in a PVC cylinder, 16 cm diameter and 68 cm long, and can run unattended for four months with a one-minute sampling rate. Instruments are buried to achieve temperature stabilisation, and can be tested, reprogrammed and interrogated in the field using a portable PC.

The instruments performed very successfully; the data recovery rate exceeded 85%. Data losses were due mainly to premature battery failure and to the disappearance of two instruments.

Induction results

Induction effects can be represented conveniently by Parkinson induction vectors that are computed for a particular periodicity of the field fluctuations during an interval of high disturbance. In broad terms, the induction vectors should point towards an electrical conductor. They are small either directly over the conductor, or far away from the conductor. The lengths of the vectors reflect the strength of the induction effects, which relate to both the scale and electrical conductivity of the conducting region.

So far only a cursory analysis of the AWAGS data for induction effects has been completed. It shows that major distinct zones of electromagnetic induction behaviour can be identified. Induction vectors (Fig. 20) can be grouped into three regions:

- a coastal region, in which the vectors point towards the conducting oceans (the 'coastal effect') and decrease in amplitude away from the coast;
- a central craton region, and its northward extension, in which the induction arrows are small and randomly directed in the centre but — towards the rim of the craton — point outwards from the centre; and
- an intermediate region (shaded in Fig. 20), in which the induction arrows are either small or point towards the central craton and away from the coast.

The northern margin of the shaded area apparently represents an Australia-wide conductive path — the intercratonic conductive zone — which traverses the eastern Canning Basin, the Officer Basin south of the Musgrave Block, and the western margins of the Eromanga and Carpentaria Basins. Within the main crystal-line basement areas, induction effects are moderately subdued, apart from the well defined coast-effect. Work is in progress to delineate the conductor path in more detail by incorporating the results from previous small-scale array studies.

"Aeromagnetic risk" maps of Australia

Because few areas in Australia are free from induction effects (cf. Fig. 20), there are few areas where the assumption of spatial homogeneity of the fluctuating field — extensively applied in aeromagnetic data reduction — holds in detail.

Anyone deploying base-stations for aeromagnetic (or marine) survey work needs to have a feel for the differences between the diurnal signal at a base-station and the corresponding signal at a remote survey point. The AWAGS study provides the first country-wide basis for generating this base-station error information, allowing the possibility of drawing a contoured 'aeromagnetic risk' map of Australia. In fact a set of maps will be required because the base-station error, as a function of distance away from the base-station, is expected to be frequency-dependent.

The induction arrows (Fig. 20) are not directly related to base-station errors, but nevertheless do provide a crude 'aeromagnetic risk' map. The figure delineates areas where large base-station errors can be expected (high variability between induction vectors), and areas where they are going to be small (short or uniform patterns of arrows).

Recent K—Ar dating and structural mapping have enabled BMR and the Geological Survey of Western Australia to delineate and date the latest deformational stage in the King Leopold Orogen, to the north of the Fitzroy Trough of the Canning Basin. The dates have been determined for schists selected from both contractional shear zones, and rocks metamorphosed to the lower greenschist facies during the final deformation in the base-station. They indicate that the late-deformation event started in the Cambrian and continued until the latest Cambrian to earliest Ordovician (ca 500 Ma). This contractional deformation is slightly older than the earliest known Early Ordovician (Tremadoc) sedimentary rocks in the Canning Basin, and explains the lack of Cambrian rocks in the northern part of the basin.

Introduction

In 1988, BMR commenced a multidisciplinary project to review the evolution of the Canning Basin. This work is concentrated around 640 km of deep seismic data recorded in 1988, and adopts the technique of seismic stratigraphy to refine geological understanding of the basin.

In order to clarify the age of the last compressional event that affected the basement to the Fitzroy Trough, a program of age determination and structural mapping was instigated. Before the work started, the consensus was that the last major deformation to affect the King Leopold Orogen was about 600 Ma (e.g., Bennett & Gel-laty, 1970: BMR Record 1970/20). We consider that this date is too old because the poor precision of the isochrons and high initial radiometric ages suggest a lack of isotopic equilibrium in the dated samples.

The Fitzroy Trough (Fig. 21) is a deep, composite set of complex half-grabens formed during two or more extensional events in the Ordovician and in the Devonian. Later deformation in the Jurassic produced open folds with east-northeast tending axes, many of which are truncated by steep faults established during earlier Palaeozoic rifting.

Results from BMR Record 88.03 deep seismic profile in the Fitzroy Trough (inset in Fig. 21) suggest that the Phanerozoic sedimentary section might attain a thickness of 15—17 km. As the ages of the sedimentary rocks in the deeper parts of the trough are completely unknown, it has been speculated that Cambrian rocks, which occur in all the surrounding contemporary basins, might occur there too. Outside the trough, sedimentary rocks as old as the late Tremadoc are preserved in the Murchison. The 1880-1840-Ma Hooper Complex of the King Leopold Orogen is known from a single well in the southeast of the basin (McTavish & Legg, 1976: in Bassett, M.G., Ed., The Ordovician System, Proceedings of a Palaeontological Association Symposium, Cardiff, Wales).

Geological setting

The structural development of the exposed basement and Proterozoic successions in the King Leopold Orogen and adjacent Oscar and Pillara Inliers of the Lennard Shelf has been re-examined by Tyler & Griffin (1990: Journal of Structural Geology, 12, 703—714). They recognised a D1 event of localised high strain and a D2 folding event that predate the main phase of granite intrusion in the mid-Proterozoic. The D1 event, here called the Yampi Event, involved folding and formation of complex north-directed shear systems. A D2 event, here termed the Precipice Event, involved southwest-directed folding and tilting in the Precipice Fold Belt, at the southern margin of the Kimberley Basin. The dominant structural feature in the Precipice Fold Belt is the Inglis Fault, which follows the contact between the 1880—1840-Ma Hooper Complex of the King Leopold Orogen and the 1840—1760-Ma Kimberley Basin succession. Within the Precipice Fold Belt, the D1 axial-plane cleavage can be traced through the unconformity separating the Kimberley Basin succession from overlying Late Proterozoic granite rocks, which it must postdate.

Intensely foliated schist zones in the southern King Leopold Orogen and inliers to the south, regarded as high-strain zones active at the close of the D1 Precipice Event, include the south-dipping,