Data Example

To demonstrate the superiority of the wide-tow sleeve gun array, a line was recorded twice along a traverse in the Carnarvon Basin offshore Western Australia. The first recording used a conventional airgun array, whilst the second recording used the new external sleeve guns configured in a wide-tow array.

Both lines were processed using identical parameters. The filtered and scaled stack of the conventional data is shown in Fig. 5, and that of the 'versatile source' shown in Fig. 6. The new data reveals a much higher frequency content and resolution level both in the shallow zone and at depth. Many of the details revealed on the new data are masked by a low frequency reverberation on the conventional airgun array stack. In addition, much of the noise apparent on the conventional data, particularly above 1.5 seconds, has been attenuated by the wide-tow array.

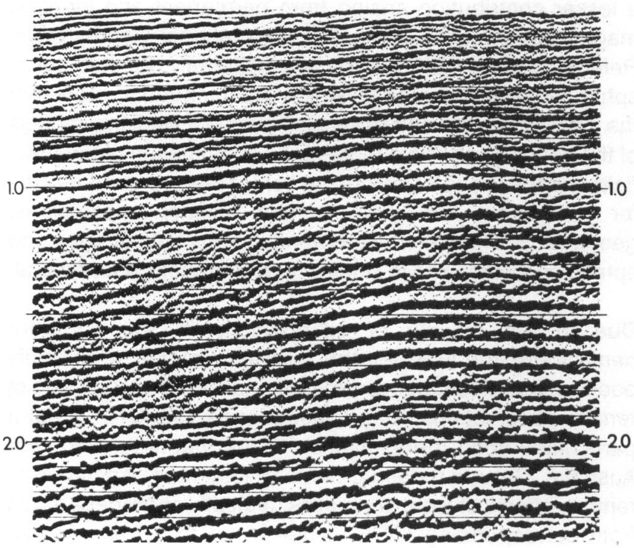

FIGURE 5
Filtered and scaled stack data shot using conventional airgun array.

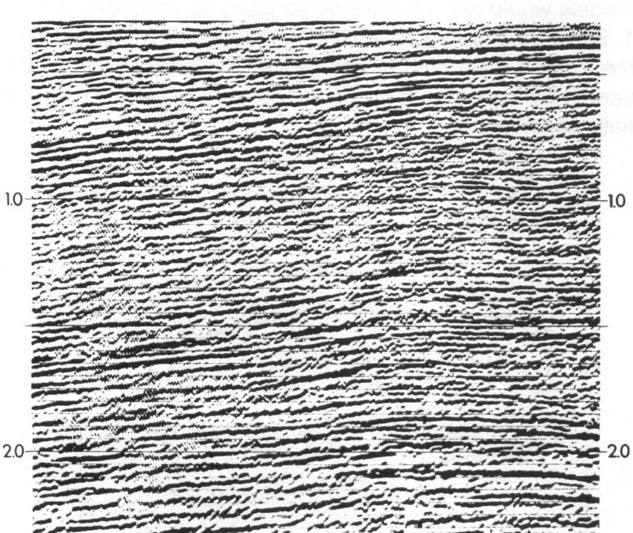

FIGURE 6
Filtered and scaled stack data shot using wide-tow sleeve gun array.

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AIRBORNE RAPID RECONNAISSANCE FOR OIL AND GAS

A. R. Barringer

Oil and gas fields and productive regions rich in mature source rocks are associated with the widespread leakage to the surface of trace amounts of hydrocarbons. In oil prone areas, these micro-seeps include liquid phase C10+ hydrocarbons which penetrate not only to the sea floor in offshore areas, but also to land surfaces.

In offshore exploration, gas leakage from the sea floor generates bubbles that are very effective carriers of interfacial films of crude oil. Such bubbles on reaching the ocean surface inject oil coated aerosols into the atmosphere and simultaneously deposit traces of oil on the sea surface. An airborne system known as AIRTRACE[R] has been developed to detect the aerosol phenomenon at high sensitivity. The equipment is operated in a low flying, twin-engine, STOL aircraft that carries a nose-mounted collection system capable of concentrating the atmospheric aerosol content by more than one million times. Hydrocarbons are desorbed and analyzed from this aerosol on a continuous stream basis and the concentrations are recorded digitally forty times per second and also displayed in analog profile form. Simultaneous recordings are made of position using Loran C and GPS systems as well as measurements of humidity, air temperature, sea surface temperature, air speed and turbulence, sea surface optical characteristics, terrain clearance and magnetic field strength. Post-flight maps are produced in the field at the aircraft base using micro computers to facilitate interactive control of operations. Production rates vary between 400–1000 line kilometres a day where good weather prevails and ferry distances are not more than 200 km.

A second airborne system is currently under development that employs laser technology for the remote sensing of hydrocarbon leakage effects. This proprietary system known as FLUOROSCAN uses a short high intensity UV pulse to detect at high sensitivity fluorescence in oil coated aerosols, surface slicks and water column dispersions of oil. The technology is an outgrowth of an earlier laser system developed for pollution monitoring that has been used extensively in offshore surveys. A new high speed electronic switching technique is employed to separately discriminate for water and aerosol effects. Survey speeds are anticipated to be almost double those of AIRTRACE since the drag of the aerosol sampling equipment is eliminated and a faster aircraft can be employed. A further potential advantage of the FLUOROSCAN equipment is a relatively high degree of weather tolerance which should be a very important factor in some areas of the world.

In addition to measuring the primary effects of hydrocarbon leakage with these geochemical systems, a secondary phenomenon relating to the development of anomalous susceptibility along sedimentary leakage pathways can be simultaneously monitored with high sensitivity aeromagnetic equipment. This integration of airborne geochemical methods with airborne geophysics appears attractive but is still under evaluation.

The full value of these systems can only be properly evaluated when there has been extensive followup by drilling. At the present time however it would appear that there is a general occurrence of hydrocarbon leakage activity in the form of clusters in areas that are either productive or potentially productive. Conversely regions devoid of mature source rocks are believed to exhibit very little geochemical leakage. If this relationship is substantiated, then these rapid reconnaissance airborne techniques can be used as a followup to regional seismic surveys or as a means of directing primary seismic coverage. The ultimate objective is to identify those seismic prospects that are closely associated with dynamic oil and gas seepage.

Overland adaptations of these airborne geochemical and geophysical methods are currently under consideration and the results of extensive surface research on primary and secondary leakage effects as they may relate to the airborne techniques are very encouraging. The outcome of this work will be reported.

R = Registered trademark of Barringer Resources Inc.

THE AUSTRALIAN GEOMAGNETIC REFERENCE FIELD—ITS BASIS AND APPLICATIONS

C. E. Barton, P. L. McFadden and A. J. McEwin

Introduction

The magnetic field at the surface of the Earth, when averaged over a sufficient interval of time to remove transient variations (nominally 1 year), consists principally of a contribution originating from the Earth's core, called the 'main field', and a lesser contribution arising from permanent and induced magnetization of the crust. The International Geomagnetic Reference Field (IGRF) is the internationally adopted set of spherical harmonic models which are intended to represent the main (core) field and its secular variation. Regional models of the geomagnetic field represent a combination of the main field and the broad-scale crustal field. They are used as aids for navigation, surveying, certain military applications, geophysical exploration, determination of sea-floor ages and spreading history, and in studies of geomagnetic phenomena.

Due to the paucity of observations in the southern hemisphere, the IGRF for the Australian region is relatively poorly constrained, being dependent on a high proportion of remote observations. As a consequence, the IGRF is not a particularly good representation of the magnetic field over Australia. Ground measurements of total field, smoothed to remove effects of local anomalies, typically show departures from corresponding IGRF values of up to a few hundred nanotesla. Differences between the regional model for 1980 (BMR/80) and IGRF 1980 are illustrated in Fig. 1. IGRF 1980 was a particularly accurate model of the field because it included a large amount of MAGSAT data. Fits to regional models would not normally be as good as illustrated in Fig. 1. Since by definition the IGRF is the best representation of the Earth's main field in any region it is not intended, and cannot be expected to give a very close match to the actual field observed.

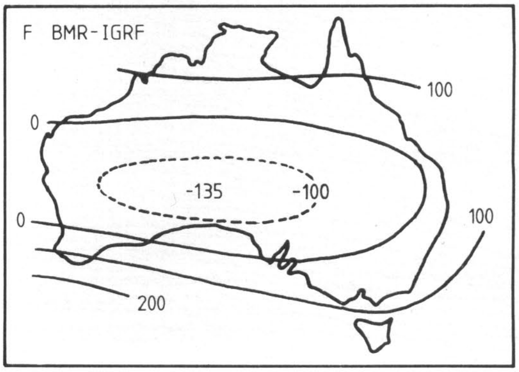

FIGURE 1
Contoured differences in total field between the BMR regional model for 1980, BMR/80 and IGRF 1980.