BASEMENT STRUCTURE UNDER THE CENTRAL EROMANAGA BASIN FROM SEISMIC REFRACTION STUDIES

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BIOGRAPHY

Jo Lock graduated from Mitchel College of Advanced Education as a mathematics teacher and taught in N.S.W. high schools for 10 years. After part-time followed by full-time studies she obtained her B.Sc. (Hons. 1) from the School of Applied Geology, the University of N.S.W. in 1976. She then engaged in post-graduate geophysical studies at the Research School of Earth Sciences, ANU until she joined BMR in 1980 as a geophysicist. Since then she has worked on the acquisition and interpretation of central Eromanga Basin seismic refraction data.

SUMMARY

In 1980 and 1981 the Bureau of Mineral Resources, Geology and Geophysics (BMR) conducted seismic surveys in the central Eromanga Basin, which included continuous seismic reflection and coincident refraction recording along a line extending from Mt. Howitt No. 1 Well in the west to Cheepie in the east (Figure 1). Refraction stations were spaced at 1.875 km intervals out to distances of 75 km to study the velocity structure of the Eromanga sequences, underlying basins and basement. All seismic refraction lines were reversed. Data at the western end of the line (Mt. Howitt Well to Tallyabra) are presented in this interpretation.

The representative velocity model from first arrival data presented here, is simple but allows several conclusions to be drawn about basin and basement structure with depth. No strong primary reflection branches are observed at short distances (less than 20 km) therefore the velocity of the basin sequence is interpreted as increasing continuously from 2.3 km/sec at the surface to 4.8 km/sec at 2.4 km depth (Figure 2). Arrivals between 8 and 20 km have a lower apparent velocity than those recorded at greater distances. This indicates that the low grade Ordovician meta-sediments encountered in Mr. Howitt Well log may extend to the east under the Eromanga Basin. Arrivals beyond 20 km are from basement, where velocity increases relatively rapidly to 5.9 km/sec at 7 km depth. Clear impulsive first arrival persist with appreciable amplitudes out to 100 km. At greater distances amplitudes are greatly reduced, arrival become emergent and their nature changes. This implies structure where basement velocity reduces from 5.9 km/sec at 7 km depth to 5.7 km/sec at 7.5 km.

A feature of seismic refraction data in this region is a sequence of clear later arrivals which, in general, consist of an energy packet of the same shape as the initial onset but often larger amplitudes. There are at least three such arrival identifiable on any record section and as many as six may be identified on some. These later arrivals are observed beyond 10 km to at least 40 km and possibly to 60 km, though unambiguous identification of these arrivals is difficult at larger distances. Their amplitude and arrival time characteristics indicate they are not multiple reflections from the basin/basement interface. They are probably refracted arrivals multiply reflected at the surface. Reflection coefficients for a range of angles of incidence at a low velocity surface layer and ray tracing, carried out to determine whether a velocity model of this type can explain these arrivals in this manner, will be presented. These arrivals further constrain the velocity variation with depth in the uppermost crust.

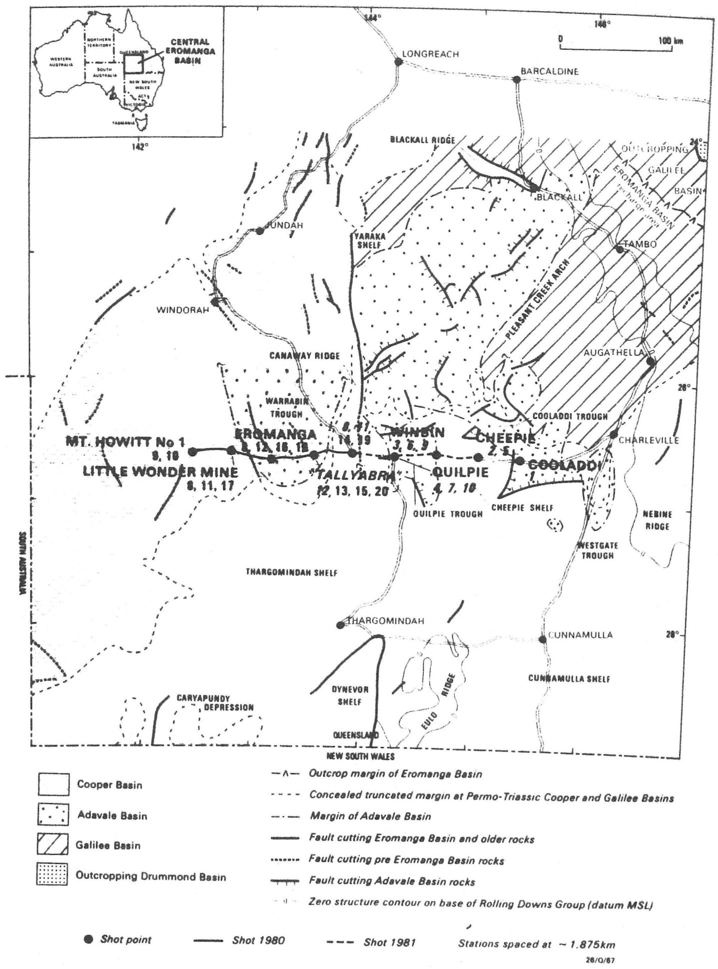

Fig.1 Location diagram.

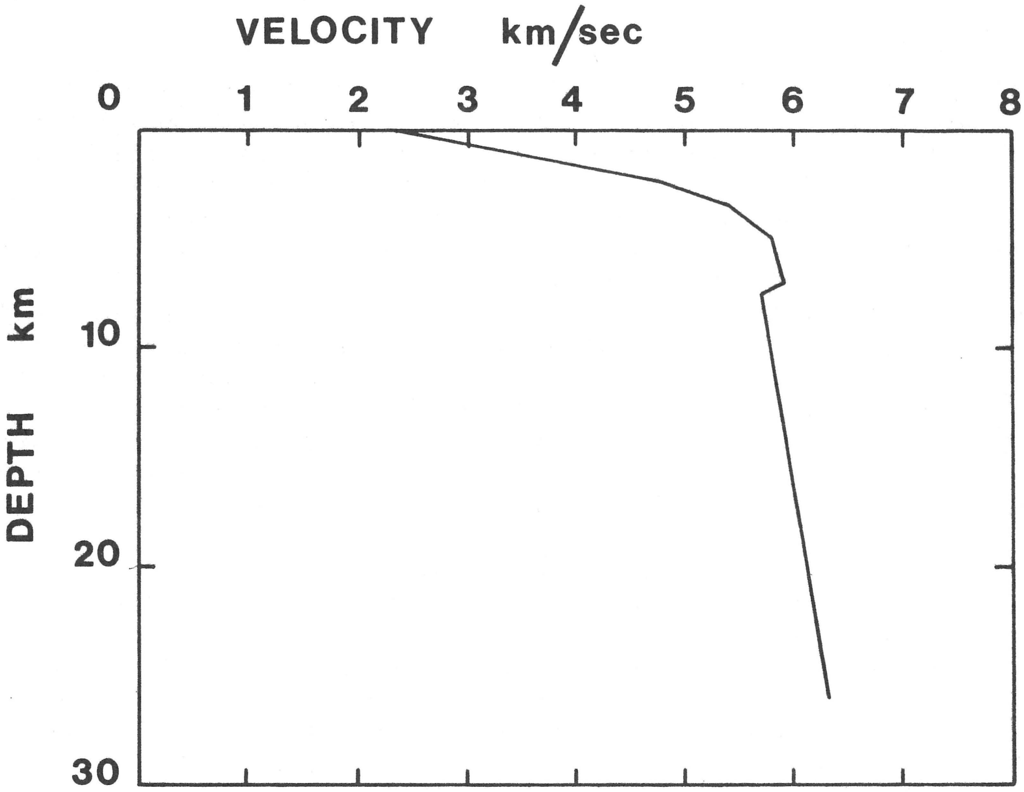

Fig. 2 Velocity/depth profile from Mt. Howitt No.1 Well to Eromanga.