COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1962/169

AMADEUS BASIN, GRAVITY MEASUREMENTS ALONG SEISMIC TRAVERSES, NT 1961

by

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ILLUSTRATIONS

SUMMARY

In August 1961, gravity readings were made at shot-points along seven seismic traverses which had been recorded by the Bureau of Mineral Resources in the Amadeus Basin.

The main purpose of the gravity survey was to supplement the seismic information along these traverses.

In general there is not a great deal of similarity between the gravity profiles and the geological and seismic cross-sections. This is believed to be caused by large scale over-thrusting and by near-surface basic and ultrabasic crystalline material.

1. INTRODUCTION

From 25th to 28th August 1961, gravity readings were made along seven seismic traverses recorded by the Bureau of Mineral Resources in the Amadeus Basin. The location of these traverses is shown on Plate 1. The gravity readings were made at seismic shot-points, which were generally at ¼-mile separation.

Worden gravity meter No. 61, having a calibration factor of 0.08994 mgal/div was used for the work. The calibration factor of the instrument was checked on the Alice Springs calibrating range at the completion of the work.

Although along most traverses the terrain made the carrying of a gravity meter difficult, frequent drift checks of the instrument were possible. It is considered that the main cause of instrument drift was the large diurnal variation of temperature experienced in this region; drift rates in the mornings were always very large. However, it was noticed that the time lag between the onset of the large drift rate and the time at which the instrument was removed from its carrying-can appeared to change from day to day, and there appears to be some relation between meter performance and the type of terrain traversed.

All shot-point levels were tied to the level datum of the Central Australian railway line and a gravity tie was made between each traverse and the nearest convenient mile-post on the railway. Hence the profiles as presented are relative one to another. It is planned to include these mile-posts in a gravity tie between the Alice Springs and Oodnadatta pendulum stations in 1962 so that all the gravity stations will then be adjusted to the pendulum network and the data will be incorporated in the gravity map of Australia. The immediate purpose of the gravity survey was to supplement seismic information along these traverses.

2. DISCUSSION OF RESULTS

As with the gravity survey of the Amadeus Basin as a whole (Langron, 1962),a rock density of 2.2 g/cm^3 has been used in the reduction of the field readings to Bouguer-anomaly values. The results in the form of Bouguer-anomaly profiles are presented on Plate 2 which also shows the corresponding geological and seismic cross-sections.

In general, there is not a great deal of similarity between the gravity profiles and the geological and seismic cross-sections. It would be unreasonable to expect any simple relation in an area tectonically so disturbed and where steep gravity gradients are located over outcropping Archean rocks. The difficulties of gravity interpretation in this Basin have been mentioned by the writer previously (Langron, 1962); it is inferred that the gravity pattern, especially in the northern portion of the area considered here, is complicated by large-scale overthrusting of Archean rocks upon more recent formations and the presence of relatively near-surface basic and ultrabasic crystalline material. The normal density relationships which can be expected in a sedimentary basin are upset here because of the relatively low density of some of the older rocks. Of special importance is the

low density of the Bitter Springs Limestone (2.04 to 1.89 g/cm^3 according to Magellan Petroleum Corporation, personal communication). Therefore, the possibility of lithological changes producing marked lateral density variations unrelated to structural features should not be overlooked.

The gravity profiles should be examined more for individual features rather than in respect of their slopes. The relative gravity 'high' about Shot-point 659 on the Black Hills traverse is of interest because it correlates with a deep-seated feature shown in the seismic cross-section. A similar correlation could exist about Shot-point 110 on the Mount Polhill traverse, though here the gravity expression of the anticline is obscured by the steepness of the gravity gradient. There is a suggestion, however, of a double hump in the 'residual' gravity anomaly. The only other gravity feature of interest is the steep gradient between Shot-points 401 and 408 on the Mount Charlotte traverse. This gravity gradient is not confirmed by any corresponding observed feature in the seismic cross-section but it may be that it is related to tectonic displacement within the Mount Charlotte Anticline that is outside the seismic traverse.

3. CONCLUSIONS

The gravity profiles are of limited value for correlation with seismic work in this area. To be of greater value, the traverses should in general be longer and be considered in relation to the regional gravity pattern. A review of these traverses will be made in the final review of the helicopter gravity survey made in this area.

4. REFERENCE

LANGRON, W.J. 1962 Amadeus Basin reconnaissance gravity survey using helicopters, NT 1961. Bur. Min. Resour. Aust. Rec. 1962/24.

PLATE I

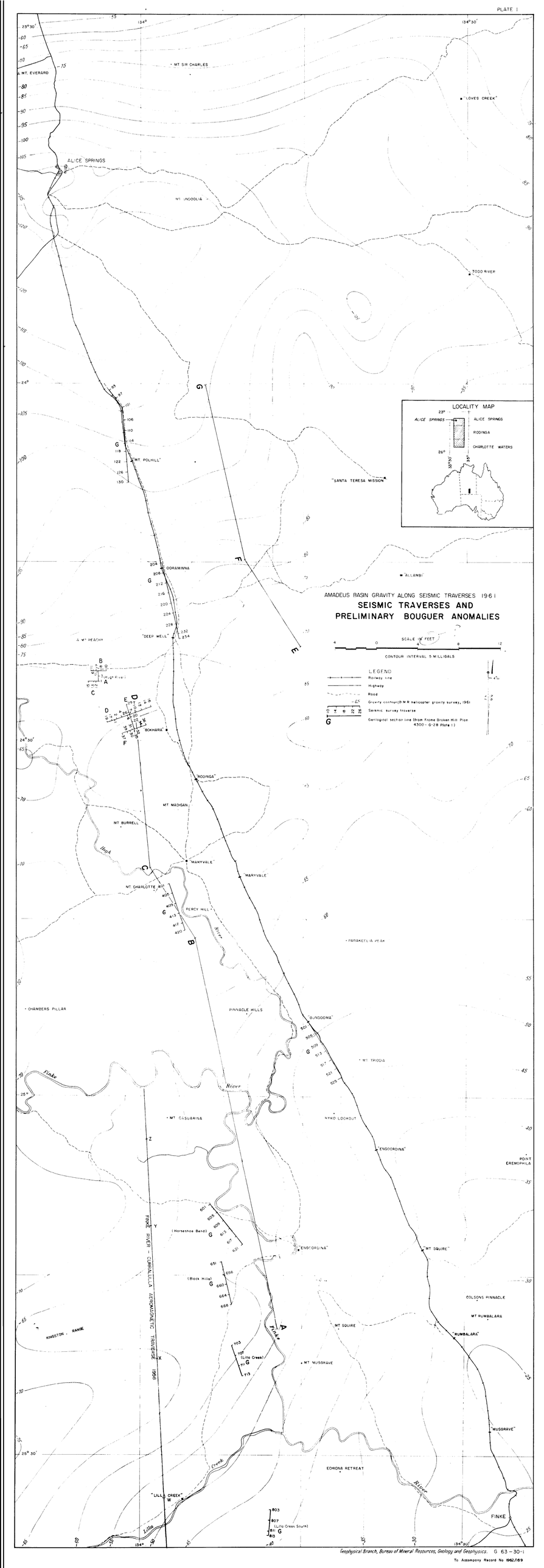

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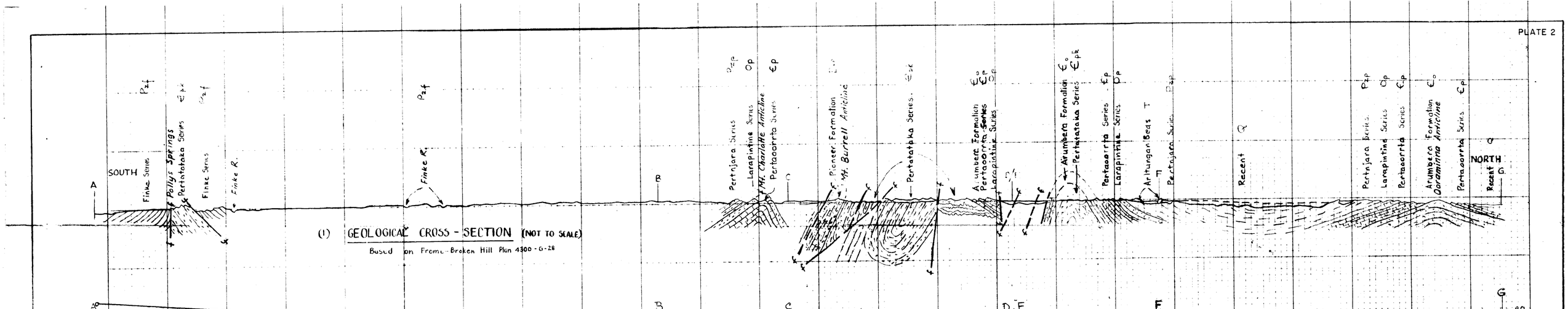
PLATE 2

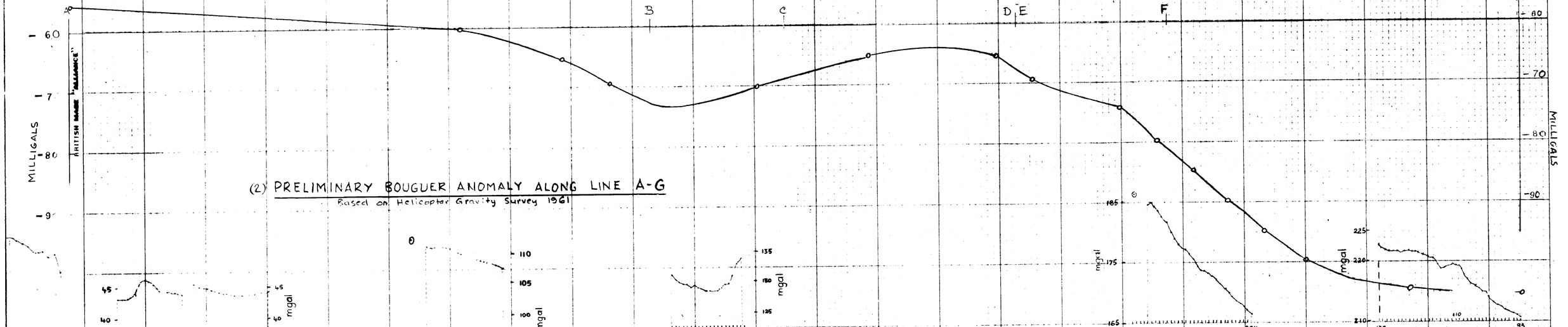
(1) GEOLOGICAL CROSS - SECTION (NOT TO SCALE)

Based on Frome-Broken Hill Plan 4300-G-28

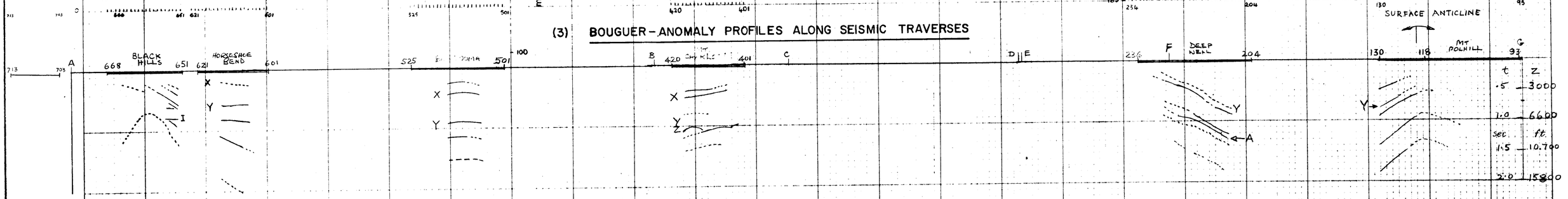


(2) PRELIMINARY BOUGUER ANOMALY ALONG LINE A-G

Based on Helicopter Gravity Survey 1961



(3) BOUGUER-ANOMALY PROFILES ALONG SEISMIC TRAVERSES



I = ANOMALOUS HIGH AMPLITUDE ALIGNMENT POSSIBLY (?) OF INSTRUMENTAL ORIGIN. NO DIP.

X = REFRACTOR V = 16500 ft/sec
Y = REFRACTOR V = 20,000 ft/sec
? JAY CREEK LIMESTONE

X = REFRACTOR V = 16800 ft/sec
Y = REFRACTOR V = 20,000 ft/sec
? JAY CREEK LIMESTONE

X = REFRACTOR V = 16800 ft/sec
Z = POSSIBLE DIFFRACTION
Y = REFRACTOR V ≤ 20000 ft/sec } ACTUAL DEPTH NOT
? JAY CREEK LIMESTONE } DETERMINED TO DATE

Y = REFRACTOR V = 20,000 ft/sec
? JAY CREEK LIMESTONE
A = ? ARUMBERA

Y = ? JAY CREEK LIMESTONE

REFLECTION QUALITY: GOOD, FAIR, POOR, DOUBTFUL

(4) COMPOSITE SEISMIC CROSS-SECTION - TRAVERSE G

Based on BMR SEISMIC SURVEY 1961

GRAVITY PROFILES AND GENERALISED CROSS-SECTIONS ACROSS BASIN

SCALE IN MILES

4 0 4 8 12

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