COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record No. 1971/84

Orroral Valley Seismic Survey, A.C.T., 1970

by
B. H. Dolan and R. J. Whiteley

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CONTENTS

ILLUSTRATIONS

SUMMARY

The Bureau of Mineral Resources made a seismic refraction investigation in the Orroral Valley, ACT, as part of a nation-wide survey of 'representative basins' instigated by the Australian Water Resources Council. The deepest refractor encountered occurred at a depth ranging from 5 to 18 metres. The results also indicated a structural lineation.

1. INTRODUCTION

At the request of the Geological Branch of the Bureau of Mineral Resources (BMR), the Engineering Geophysics Group carried out a seismic survey in the Orroral Valley, SSW of Canberra, ACT. The purpose of this survey was to determine weathering and bedrock conditions in a "Representative Granite Basin". Field Work was done in March 1970 by a party consisting of R.J. Whiteley (Party Leader), D. Tarlinton (Technical Assistant) and R. Cherry (Field Hand). Interpretation was done by B.H. Dolan and R.J. Whiteley.

The location of the survey is shown in Plate 1.

The "Representative Basin Concept" suggested by the Australian Water Resources Council (A.W.R.C.) attempts to provide general classifications of areas on the basis of a multiplicity of parameters including surface, relief, geology, and rainfall. The Orroral Valley, ACT, is in an area classified in this system as Type $5H_{gp}$ (Australian Water Resources Council, 1969). This classification encompasses areas of very high surface relief (greater than 1200 feet) containing rocks of mostly granitic type (more than 30 percent) and low grade metamorphics (more than 30 percent).

2. GEOLOGY

In the area surveyed, bedrock consists of contaminated Ordovician granodiorite and low to medium grade metamorphosed Ordovician sediments (Snelling, 1960).

The Orroral Valley itself is a mature alluviated valley probably of Miocene-Pliocene age, trending in a southwesterly direction. There is some indication of several cycles of post-Tertiary dissection, the most recent of which trends northwest and has reached the gauging weir in the surveyed area. Regional geological evidence and borehole information suggest that the weathered Tertiary profile attained a maximum thickness of about 30 m (100 ft).

3. METHODS AND EQUIPMENT

Four intersecting seismic refraction traverses were done using the standard BMR overlapping spread technique. A geophone spacing of 3 m (10 ft) was employed with numerous shotpoints at varying shotpoint-to-geophone spread distances up to 60 m and using explosive charges of up to 0.7 kg. S.I.E. 24-channel seismic refraction equipment was used. The traverse locations and geology are shown in Plate 2.

4. RESULTS

The seismic results were interpreted using the reciprocal method (Hawkins, 1961). Depths to the deepest refractor encountered were calculated at each geophone position and reproduced as a continuous bedrock profile. Depths to shallower refractors were calculated at each shotpoint and interpolated between the shotpoints. The subsurface layers encountered were classified according to their velocities (Table 1).

Table 1

Seismic velocity ft/s	Inferred rock type
1500 - 3000	Soil, unconsolidated alluvial material.
4000 - 5000	Saturated unconsolidated material, or completely weathered bedrock.
6000 - 8000	Heavily to moderately weathered bedrock.
13000 -16000	Unweathered bedrock.

5. CONCLUSIONS

The thickness of soil and unconsolidated material in this area is generally about 1.5 m (5 to 6 ft). There is a thickening of this material towards the west on all traverses. In this area it thickens to 3½-5½ m (11-18 ft).

The underlying layer generally has a velocity of from 4000 to 5000 ft/s and is considered to be saturated unconsolidated material or highly weathered bedrock. On Traverse 4 this layer is not present. The depth to bedrock ranged from 5 to 18 m (15 to 60 ft).

The refractor immediately above bedrock varies significantly on different traverses. The average velocity in the bedrock also varies on different traverses. These averages are tabulated in Table 2.

Table 2

Traverse	Average bedrock velocity, ft/s	Average weathered-layer velocity, ft/s
1	15,000	6,600
2	13,700	4,900
3	15,100	6,800
4	14,300	6,000

The correlation between bedrock and weathered-layer velocities suggests that this layer is bedrock weathered in situ. There is a higher velocity in bedrock in a direction approximately NNW, and velocity anisotropy is even greater in the weathered bedrock layer. This indicates greater weathering aligned in a NNW direction, and suggests a structural lineation in that direction. Snelling (1960), discussing the structure of the Murrumbidgee batholith, says that most components of the batholith are foliated to some extent and are strongly jointed. He mentions that foliation is best developed in the Clear Range granodiorite, of which the granodiorite in the area surveyed is part. In this component there is a remarkable constancy of strike at about 15° west of north (Snelling, 1960, p. 190).

This agrees with the seismic evidence and could be checked when excavation is made for the weir.

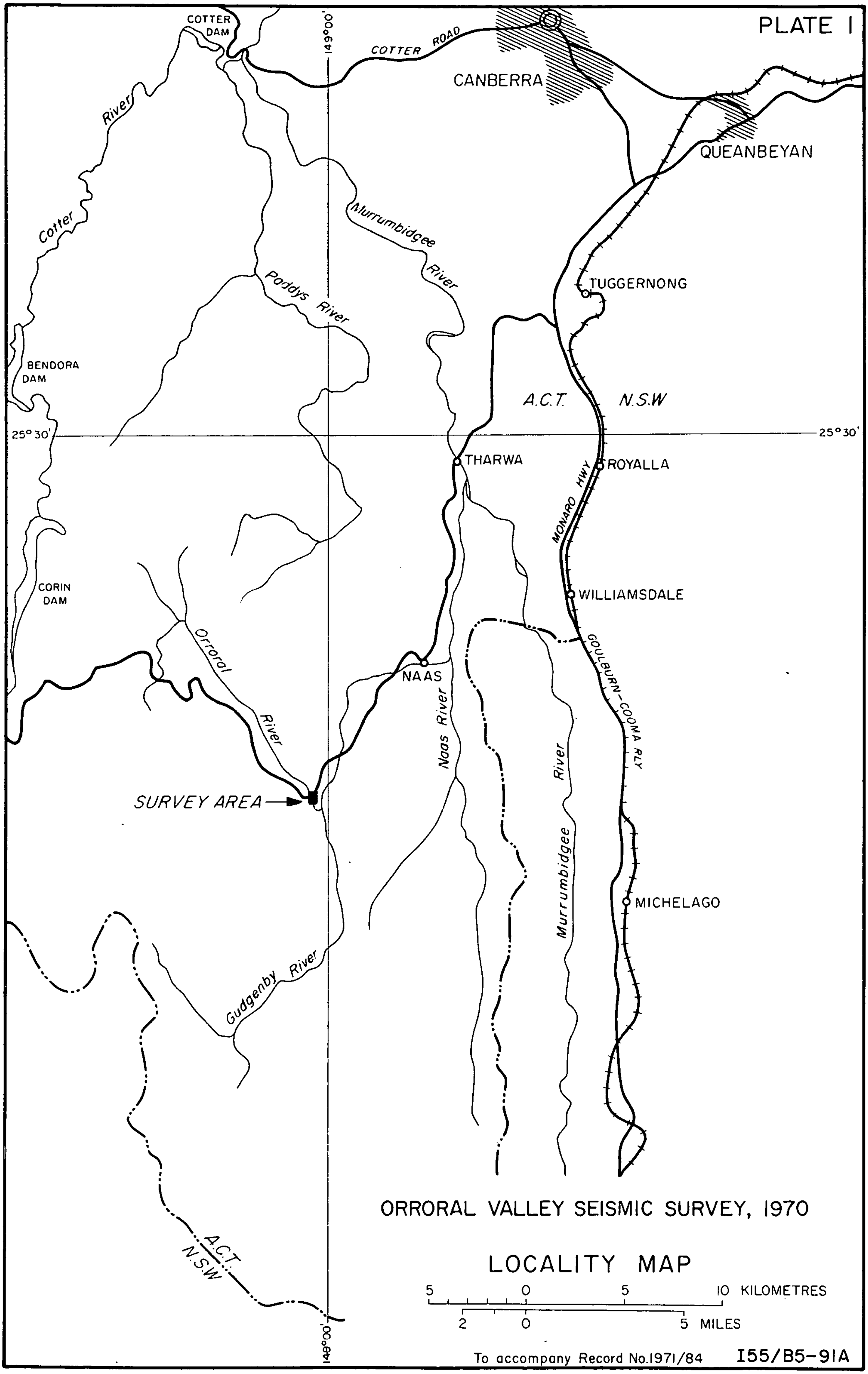
6. REFERENCES

AUSTRALIAN WATER RESOURCES COUNCIL, 1969 - The Representative Basin concept in Australia (A progress report). Australian Water Resources Council Hydrological Series No. 2.

HAWKINS, L.V., 1961 - Reciprocal method of routine seismic refraction investigations. Geophysics. 26(6).

SNELLING, N.J., 1960 - The geology and petrology of the Murrumbidgee Batholith. Quart. J. Geol. Soc., 116, 187-217.

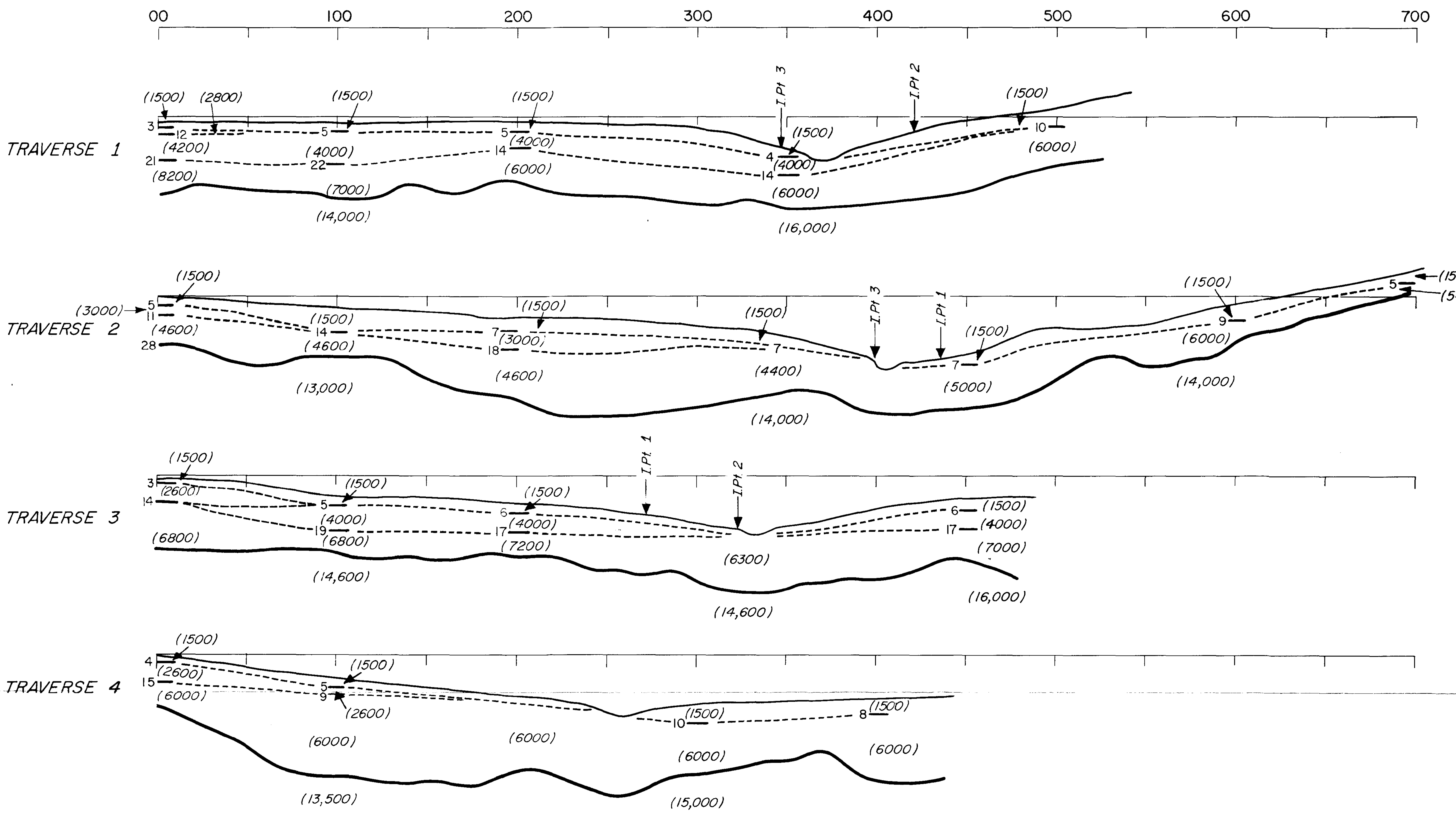
PLATE I

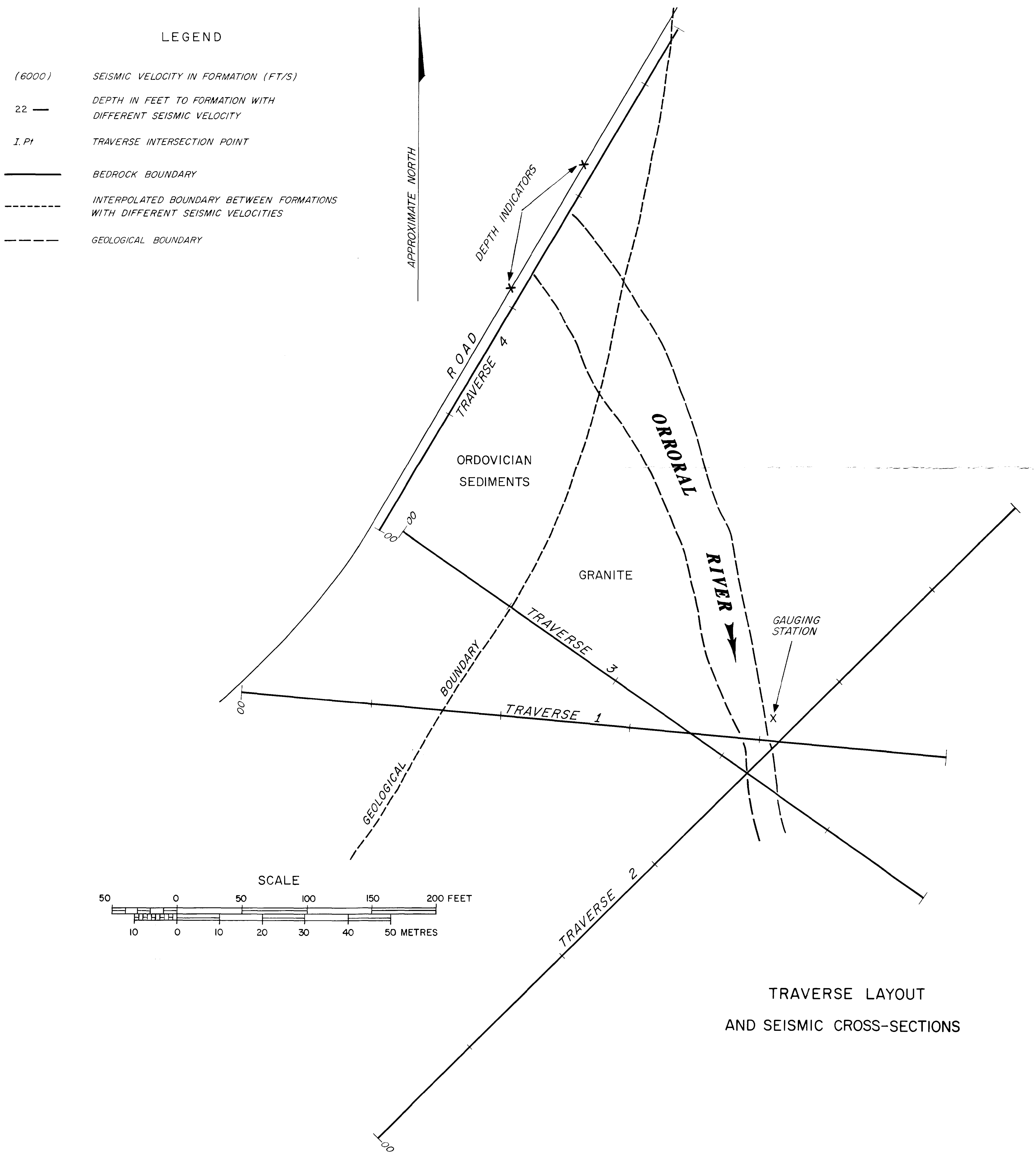


ORRORAL VALLEY SEISMIC SURVEY, 1970

LOCALITY MAP

To accompany Record No.1971/84 I55/B5-91A





TRAVERSE LAYOUT

AND SEISMIC CROSS-SECTIONS

To accompany Record No1971/84

I55/B5-92