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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF
NATIONAL DEVELOPMENT
**BUREAU OF MINERAL
RESOURCES, GEOLOGY
AND GEOPHYSICS**



008980

Record 1972/19



**SHALLOW STRATIGRAPHIC DRILLING OF RADIOACTIVE
ANOMALIES AT EYRE CREEK, SPRINGVALE SHEET
AREA, WESTERN QUEENSLAND, 1972**

by

B.R. Senior and R.J. Hughes

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CONTENTS

	<u>Page</u>
SUMMARY	
INTRODUCTION	1
ABBREVIATIONS USED IN GRAPHIC LOGS	4
DESCRIPTION AND INTERPRETATION	5
BMR Springvale 2, 3, 4, and 5	5
" " 6	5
" " 7	7
" " 8	7
REFERENCES	8

TABLES

Table 1. Summary of drilling Results	2
Table 2. X-ray diffraction and major oxide analysis results	9

FIGURES

Fig. 1. Locality Map.	
Fig. 2. Correlation and lithological logs of BMR Springvale 2, 3, 4, and 5.	
Fig. 3. BMR Springvale 6.	
Fig. 4. BMR Springvale 7.	
Fig. 5. BMR Springvale 8.	

APPENDIX

Appendix 1. Chemical analysis of samples from the Springvale area by J.W. Sheraton.	
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SUMMARY

Shallow stratigraphic drilling at Eyre Creek in the Springvale Sheet area, western Queensland in 1971:

a. Showed that relatively high gamma-ray anomalies in Cainozoic and Mesozoic sediments are due to the presence of potassium and phosphorus-bearing minerals concentrated in chemically differentiated sediments and deposits derived from them.

b. Revealed shallow pressure aquifers yielding stock water at the east side of Eyre Creek.

c. Yielded additional data on the Cainozoic and Mesozoic stratigraphy of the area.

INTRODUCTION

From 1-22 June 1971 some shallow stratigraphic holes were drilled with a BMR Mayhew 1000 rig in the Eyre Creek area on western Springvale 1:250 000 Sheet to investigate:

1. the occurrence of svanbergite, a mineral composed of alumina, phosphate, strontium, barium, minor silica, iron and lead.
2. a relatively high anomaly on the gamma-ray log of bore No. 1668 (Breadalbane No. 9).
3. the nature and thickness of Cainozoic sediments in the riverine alluvium of the Eyre and King Creek drainage system, and obtain cores of fresh Mesozoic sediments for palynological and stratigraphic study.

The project involved 312 m of drilling and 83 m of coring. A summary of the drilling results is given in Table 1.

Cuttings were collected at intervals of 150 cm while drilling with air, and 300 cm while drilling with water or mud as a circulating fluid. All core and cuttings are stored at the BMR Core and Cuttings Laboratory, Collie Street, Fyshwick, A.C.T.

The core and cuttings were logged at the well-site using a binocular microscope, and re-examined at Fyshwick for selection of sediment for X-ray diffraction, major oxide, and palynological determinations. Results of palynological determinations by D. Burger will be reported separately.

Naming of the holes is serial by 1:250 000 Sheet areas, e.g. BMR Springvale 8 refers to the eighth hole drilled by the Bureau of Mineral Resources in the Springvale Sheet area.

The composition of the minerals mentioned in the text is recorded in Table 2. Stratigraphic nomenclature is that of Vine et al. (1967). Crook's (1960) classification of arenites is followed in lithological descriptions.

TABLE 1. SUMMARY OF DRILLING RESULTS

Hole number	Total depth	Cored	Core Recovery	Section penetrated (metres)	Results
Springvale 2	24 m	Nil	Nil	0-1 Cainozoic 1-24 Allaru Mudstone	Drilled at minor svanbergite occurrence to determine its thickness. This mineral occurs at the surface and in the interval 1.3 - 3 m.
Springvale 3	30 m	Nil	Nil	0-1 Cainozoic 1-30 Allaru Mudstone	Springvale Nos 3-5 were drilled as step-outs from No. 2 to determine the extent of the svanbergite which was found to be small. Gamma-ray logs run in all holes but no anomalies occur.
Springvale 4	29 m	Nil	Nil	0-2 Cainozoic 1-29 Allaru Mudstone	
Springvale 5	23 m	Nil	Nil	0-1 Cainozoic 1-23 Allaru Mudstone	
Springvale 6	90 m	1 core 3 m	2.8 m	0-19 Cainozoic 19-46 Allaru Mudstone 46-59 Toolebuc Limestone 59-90 Wallumbilla Formation	Drilled near old mound springs near the eastern edge of the Eyre Creek alluvial belt. Pressure aquifers occurred in the Cainozoic and in the Toolebuc Limestone. Core of the Toolebuc Limestone taken. A late Pleistocene diprotodon fauna collected at drill site.
Springvale 7	33 m	1 core 2.1 m	1.9 m	0-17 Cainozoic 17-24 Allaru Mudstone (chemically differentiated) 24-33 Allaru Mudstone	Drilled to determine thickness of alluvium. Gamma-ray log shows high radioactive peak towards base of Cainozoic (12-17 m). A sample from this interval indicated the presence of jarosite. Core of Allaru Mudstone taken. Hole gamma-ray logged.

Table 1 (Cont.)

Hole Number	Total depth	Cored	Core Recovery	Section penetrated (metres)	Results
Springvale 8	76 m	3 cores Total 7m	3.6 m	0-17 Cainozoic 17-59 Allaru Mudstone 59-72 Toolebuc Limestone 72-76 Wallumbilla Formation	Drilled adjacent to gamma-ray logged Breadalbane 9 water bore. Obtained cores from radioactive anomaly near base of Cainozoic. Tests for heavy elements proved negative. Flow of saline water encountered from top of Wallumbilla Formation. No logs run.

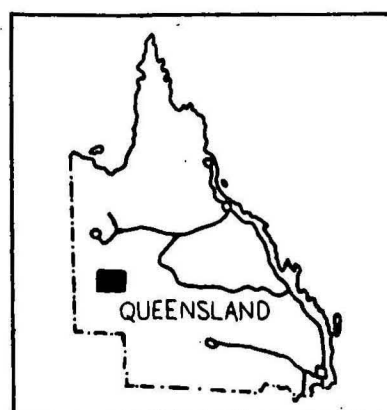
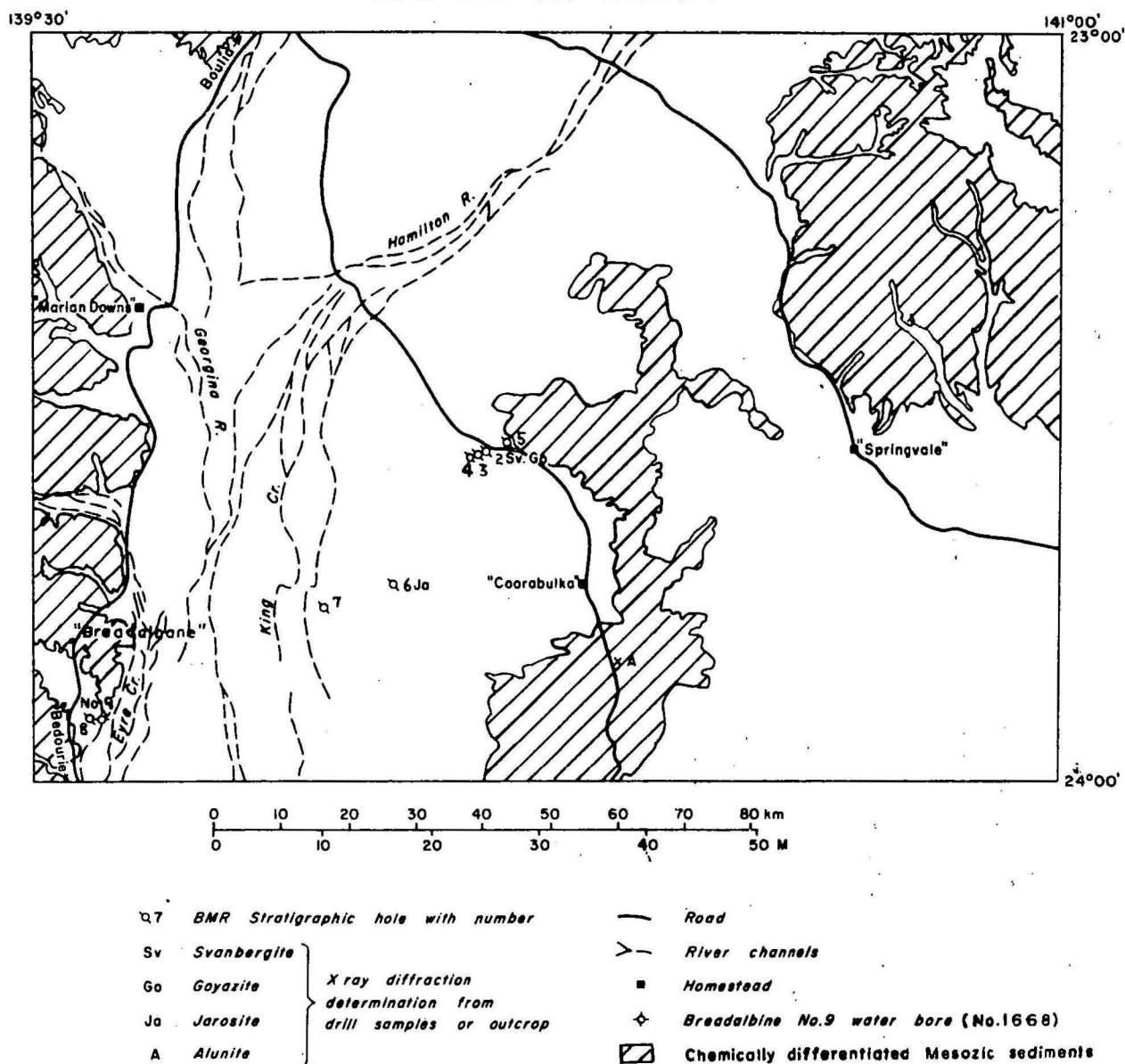
ABBREVIATIONS USED IN GRAPHIC LOGS

Alluvium	All	Layer	Lyr
Black (ish)	blk, (blk)	Lens	Len
Blue (ish)	bl, (bl)	Limestone	Lst
Brown (ish)	brn, (brn)	Medium	m
Bryzoa	Bry	Minor	mnr
Calcite (areous)	Calc, calc	Mudstone	Mdst
Carbonaceous	carb	Orange (ish)	orng, (orng)
Cemented	cmtd	Pebble	Pbl
Clay	Cl	Pink (ish)	pk, (pk)
Coarse	crs	Poorly	p
Compact	cpct	Probably	prob
Concentration	Conc	Purple (ish)	purp, (purp)
Conglomerate	Cgl	Pyrite	Pyr
Crystalline	xl	Quartz	Qz
Dark	dk	Quartzite	qzs
Fracture	Frac	Rounded	rhdd
Fragment	Frag	Sand	sd
Fine	f	Sandstone	Sst
Fossil	Foss	Scale	Sc
Grain	Grn	Silt (ly)	Slt, slt
Gravel	Gvl	Siltstone	Sltst
Grey (ish)	gy, (gy)	Small	s
Gypsum (iferous)	Gyp, gyp	Soft	sft
Hard	hd	Sorted	srted
Indurated	indd	Staining	Stng
Interbedded	inbdd	Surface	Surf
Iron	Fe	Very	v
Irregular	irreg	White (ish)	wh, (wh)
Labile	lab	Yellow (ish)	yel, (yel)

Fig 1.

EYRE CREEK ALLUVIUM AND RADIOACTIVE MINERAL DRILLING PROJECT SPRINGVALE SHEET AREA

BMR Drill site locations



DESCRIPTION AND INTERPRETATION

BMR SPRINGVALE Nos 2, 3, 4, and 5.

Position: These four holes were drilled close together south of Pigeongah Waterhole, 25 km north of Coorabulka Homestead. Co-ordinates for the drill sites are:

BMR Springvale 2 Lat. 23°33' 18" Long. 140° 10' 03"

" " 3 Lat. 23°33' 30" Long. 140° 09' 33"

" " 4 Lat. 23°33' 45" Long. 140° 08' 51"

" " 5 Lat. 23°32' 54" Long. 140° 10' 48"

Objectives: To establish the subsurface extent of a svanbergite occurrence. The mineral was discovered in 1958 by J.N. Casey and an analysis and locality is recorded by Reynolds (1965).

Drilling: The holes were drilled to an average depth of 25 m. Gamma-ray logs were run in each hole.

Results: BMR Springvale 2 established that the svanbergite at this locality (Springvale 1:250 000 Geological Map ref. s28) consists of floaters of concretionary svanbergite in colluvium. The deposit is less than 3 m thick. Holes 3, 4, and 5 sited close by penetrated colluvium without svanbergite overlying Allaru Mudstone.

A surface sample (No. 71050012) that looked like a ovoid concretion, which when broken revealed a fine-grained cream-coloured rock, was collected from the Springvale 2 drill site. It was identified by X-ray diffraction as svanbergite, and the same mineral was identified in Springvale 2 in the interval 1.3 to 3 m (No. 71050015). No gamma-ray anomaly is associated with the occurrence, so the mineral is probably present in discrete clasts. However, the top 5 m of Allaru Mudstone in Springvale No. 2 is chemically differentiated (kaolinized, silicified, and ferruginized) and the svanbergite could have originated as weathering concretions.

BMR SPRINGVALE 6

Position: Springvale SF/54-14. Lat. 23°43' 48", Long. 139°58' 51", 33 km W of Coorabulka Homestead (Fig. 1). The hole was sited near an old mound spring, 20 m northwest of an abandoned water bore.

Objectives: To determine the nature and thickness of Cainozoic sediments on the east side of the Eyre Creek floodplain and investigate the underlying Mesozoic sequence. To establish the nature of the mound-spring deposits and the origin of pressure aquifers causing the phenomena. To investigate possible radioactive zones in the Mesozoic and Cainozoic by gamma-ray logging.

Drilling: TD 90 m - Core No. 1. 50.3 - 53.3 m recovery 3.05 m
2. 89.9 - 91.1 m recovery 1.4 m

Persistent inflow of water hindered the pressure cementing of surface casing. After two attempts 18.2 m of 15 cm diameter casing was cemented in place. The cementing was unsatisfactory because a small flow was gaining access to the surface around the edge of the casing. At least four aquifers were encountered during drilling; they had a combined estimated flow of 1075 litres/hour. Because the hole was being drilled on only one 8 hour working shift per day, the amount of water accumulating around the drill site, while the rig was idle, became a problem, and the hole was prematurely abandoned. The hole was sealed with a cement plug from surface to 18 m.

Results: Cainozoic sediments are thinner than expected (Fig. 3) and consist of quartzose channel sands overlain by argillaceous sediments. The surface sediments apparently normally form an effective aquiclude to pressure aquifers in the underlying channel sand; but at this location, where the aquifers are close to the surface, water escapes and carries with it fine sediment in suspension, forming low surface mounds. The mounds are only 2 m high, but they form a striking landmark on the extremely flat, treeless, riverine plains of Eyre Creek.

The gamma-ray log shows no unusual characteristics. The high radioactivity associated with the Toolebuc Limestone interval is a characteristic of this unit wherever it occurs in the Eromanga Basin. Radioactivity within the Toolebuc Limestone probably originates in the common organic phosphatic material. The presence of uranium was suspected, but samples placed within a very sensitive radiation counter gave negative results.

Two thin beds of black calcareous labile sandstone within the Toolebuc Limestone flowed water at a rate of about 1 000 litres/hour. Analysis showed:

Depth interval 58-61 m

pH 6.5

Resistivity at 68°F (ohm-metres) 3.10

Salinity ppm NaCl 1568

Total dissolved solids (ppm) 1780

The water should be suitable for stock providing the fluorine content (not tested) is not excessive.

Fragments of silicified bone from surface gravel in the vicinity of the mound springs were identified as Diprotodon optatum and Sthenurus sp. and indicate a late Pleistocene age (M.D. Plane, pers. comm.).

BMR SPRINGVALE 7

Position: Springvale SF/54-14. Lat. 23°33' 48", Long. 139°55' 55".
39 km W of Coorabulka Homestead on the west side of Pigeongah Creek (Fig. 1).

Objectives: To establish the nature and thickness of Cainozoic deposits in the centre of the Eyre Creek floodplain, and to investigate possible anomalous zones of radioactivity.

Drilling: Drilled with air to 12 m, where the groundwater table was reached. Water circulating fluid was used until total depth at 35 m.

Results: Cainozoic silt and sand was penetrated to 17 m. Chemically differentiated Allaru Mudstone occurs from 17 m to a zone gradational to relatively fresh rock at 24 m. Fossiliferous blue-grey mudstone was penetrated to total depth at 33 m.

The gamma-ray log has an anomalous zone of radioactivity in the interval 13 to 18 m. A sample from this interval contains jarosite; the radioactivity is probably due to its potassium content (Table 2).

BMR SPRINGVALE 8

Position: Springvale SF/54-14, Lat. 23°55' 00", Long. 139°34' 43".
12 km south of Breadalbane Station (Fig. 1). The hole was sited 5 m west of water bore No. 1668 (Breadalbane No. 9).

Objectives: The hole was sited alongside the gamma-ray logged water bore to core anomalous high radioactive zones (Fig. 5). Between 12 m and 18 m (Cainozoic riverine sediments), and between 58 m and 72 m (Toolebuc Limestone).

Drilling: Cemented 9.1 m of 15 cm casing. Swelling clays occur in the basal Cainozoic and the poor core recovery was due to these clays blocking and swelling inside the core barrel.

Core 1 - 12 - 15 m recovered 1.2 m.

Core 2 - 15 - 17 m recovered 1.2 m.

Core 3 - 17 - 20 m recovered 1.4 m.

The Toolebuc Limestone was not cored because a bridge formed in the Cainozoic swelling-clay interval preventing insertion of the core barrel. Several attempts at reaming were unsuccessful.

Results: Cainozoic sand, silt, mud, and swelling clay was penetrated from the surface to 17 m (Fig. 5). Altered Allaru Mudstone was penetrated to approximately 21 m where the appearance of the sediment became relatively fresh. After penetrating the Toolebuc Limestone the hole was completed within the Wallumbilla Formation.

X-ray diffraction analysis of samples from the Cainozoic highly radioactive zone did not reveal unusual mineral assemblages (Table 2). However, the presence of alunite or a similar mineral is suspected because of the very similar stratigraphic position of the gamma-ray peak to that found in Springvale 7.

There is a marked similarity in lithological and wire-line log correlation between Springvale 7 and 8 although the holes are 38 km apart. Toolebuc Limestone aquifers occur in both localities although the quality of water apparently deteriorates westwards.

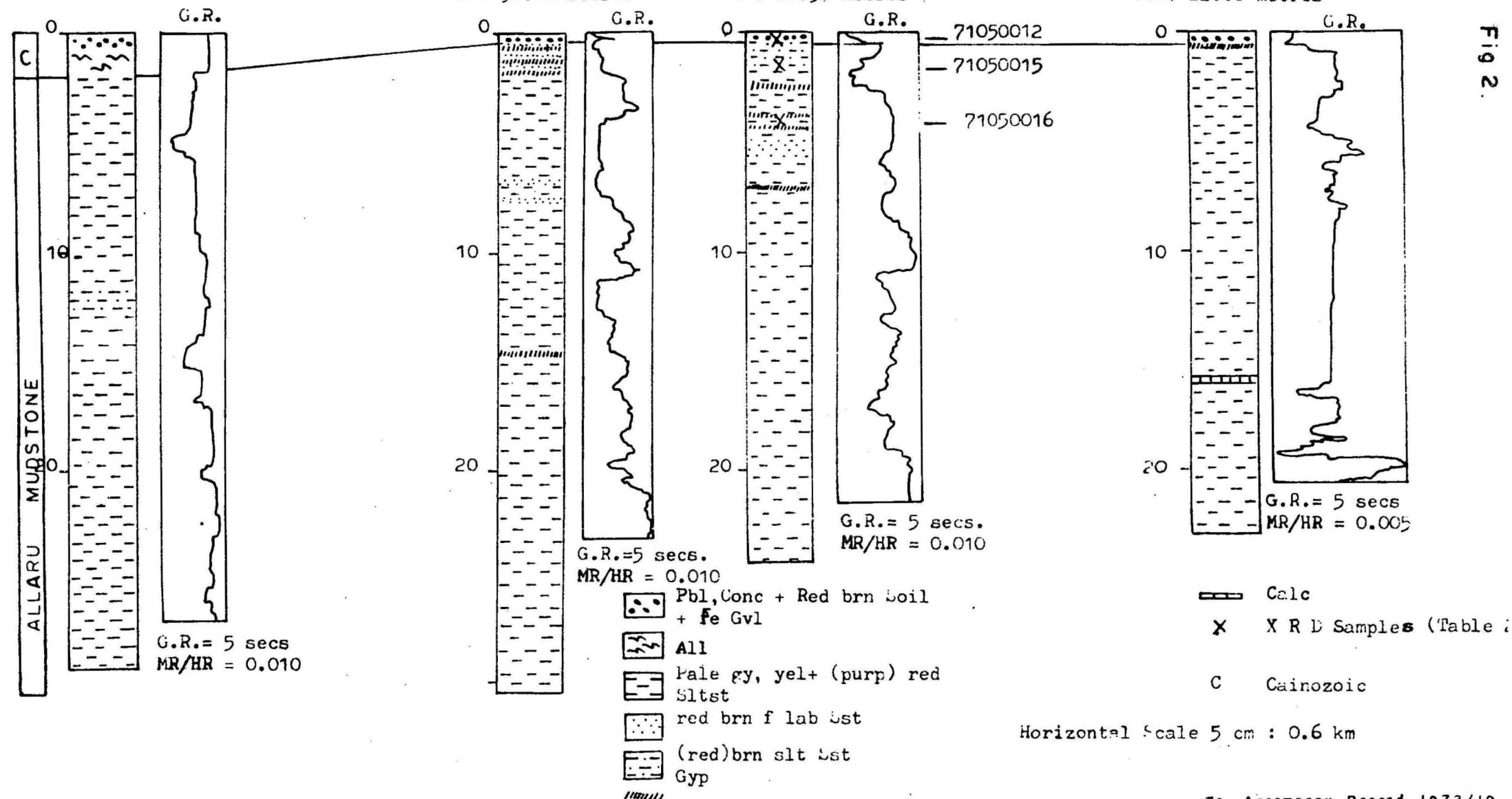
B.M.R. SPRINGVALE No.4.
T.D. 28.95 metres

B.M.R. SPRINGVALE
No.3.
T.D. 30.48 metres

B.M.R. SPRINGVALE
No.2.
T.D. 24.38 metres

B.M.R. SPRINGVALE
No.5.
T.D. 22.86 metres

Fig 2.

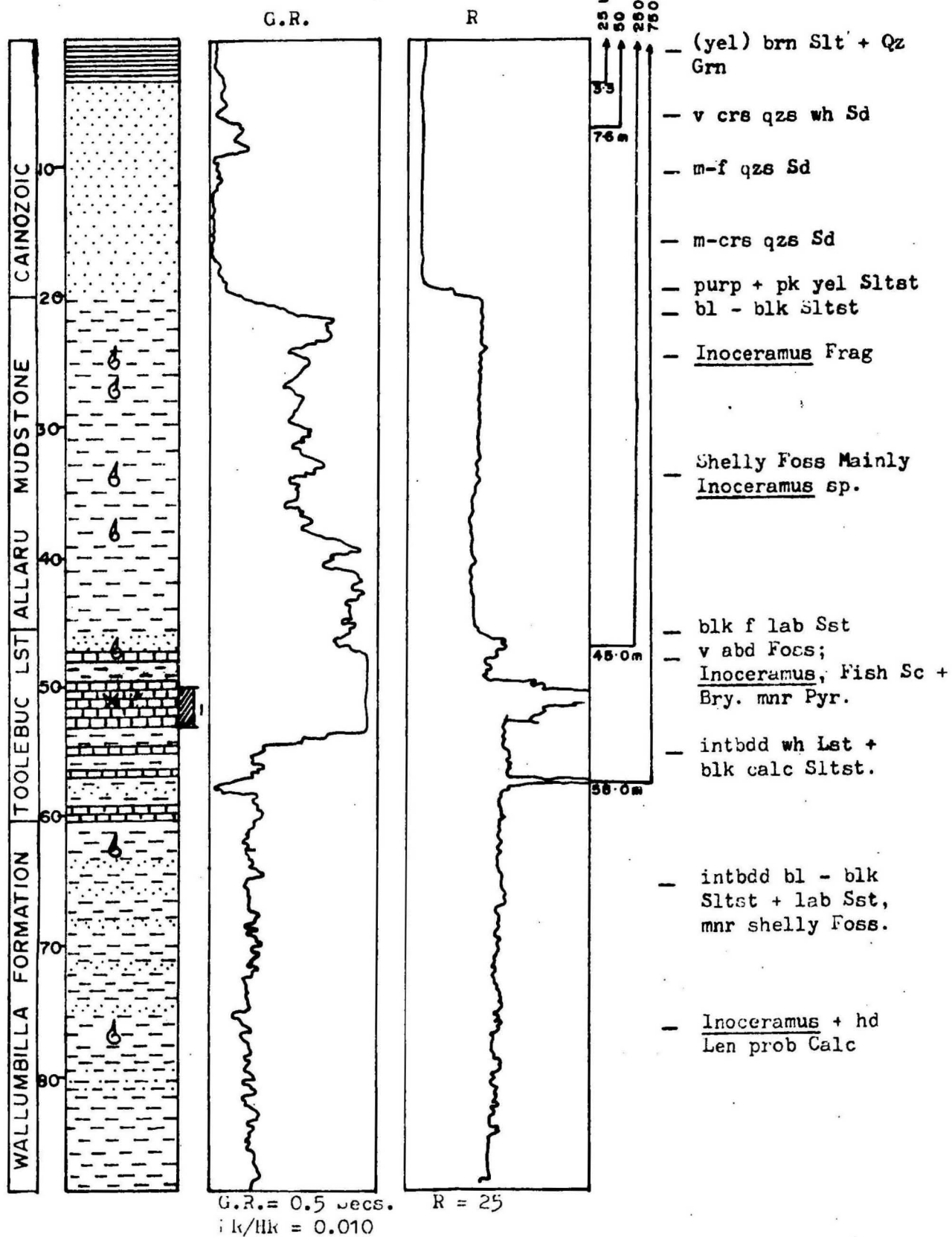


B.M.R. SPRINGVALE No.6.

T.D. 90 metres 1 Core.

Fig 3.

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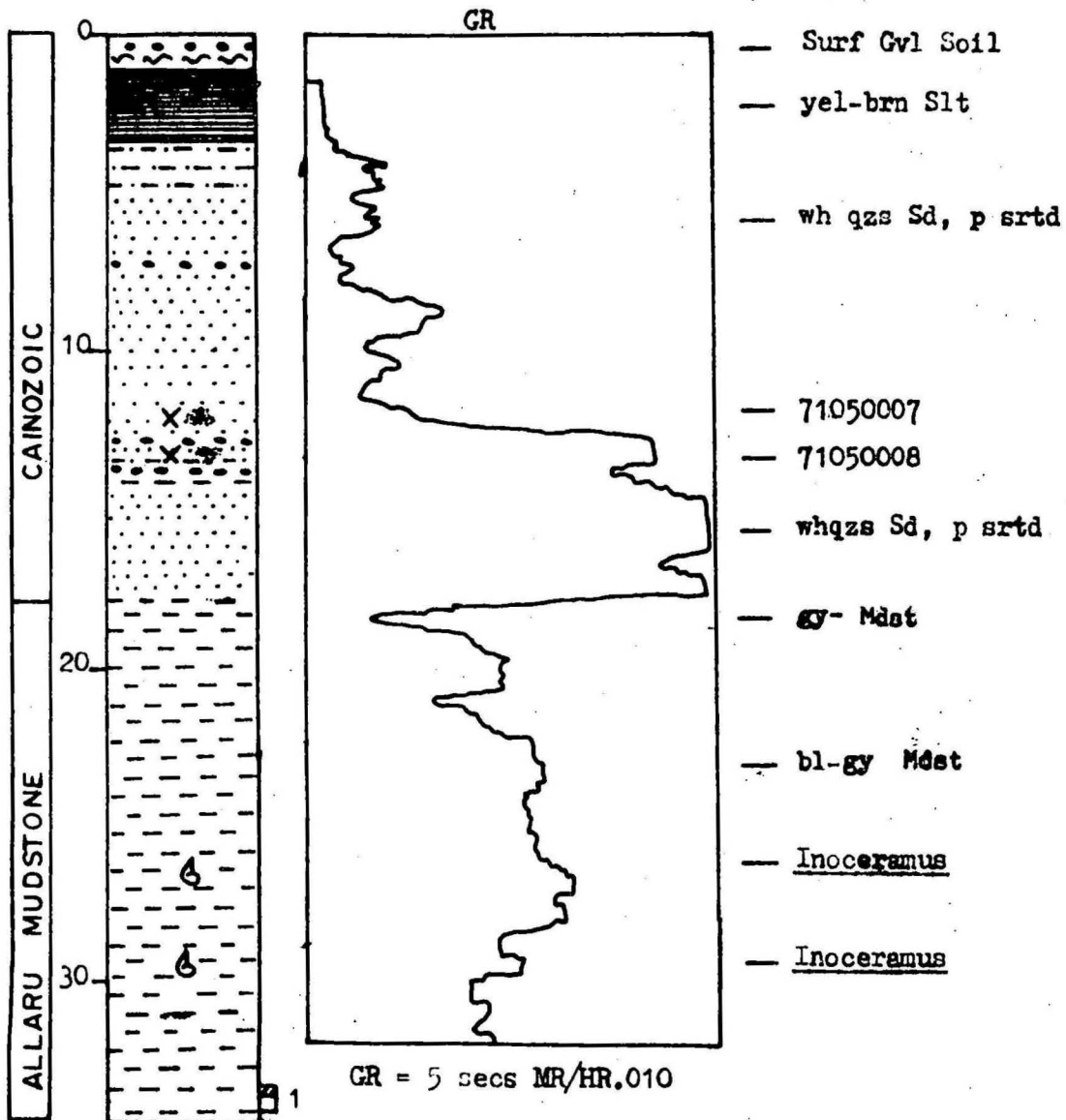
- | | | | |
|--|-----------|--|-----------------|
| | Silt | | Limestone |
| | Sandstone | | Silty Sandstone |
| | Siltstone | | Shelly Fossils |

X R D Samples 71050005 & 71050006 (Table 2).

Fig 4.

B.M.R. SPRINGVALE No. 7

T.D. 33 metres 1' core



Pebbles



Fossils



Alluvium



XRD Samples (See Table 2).



Silt



Silty Sandstone



Sandstone



Mudstone

G.R. Log of Waterbore No.1668

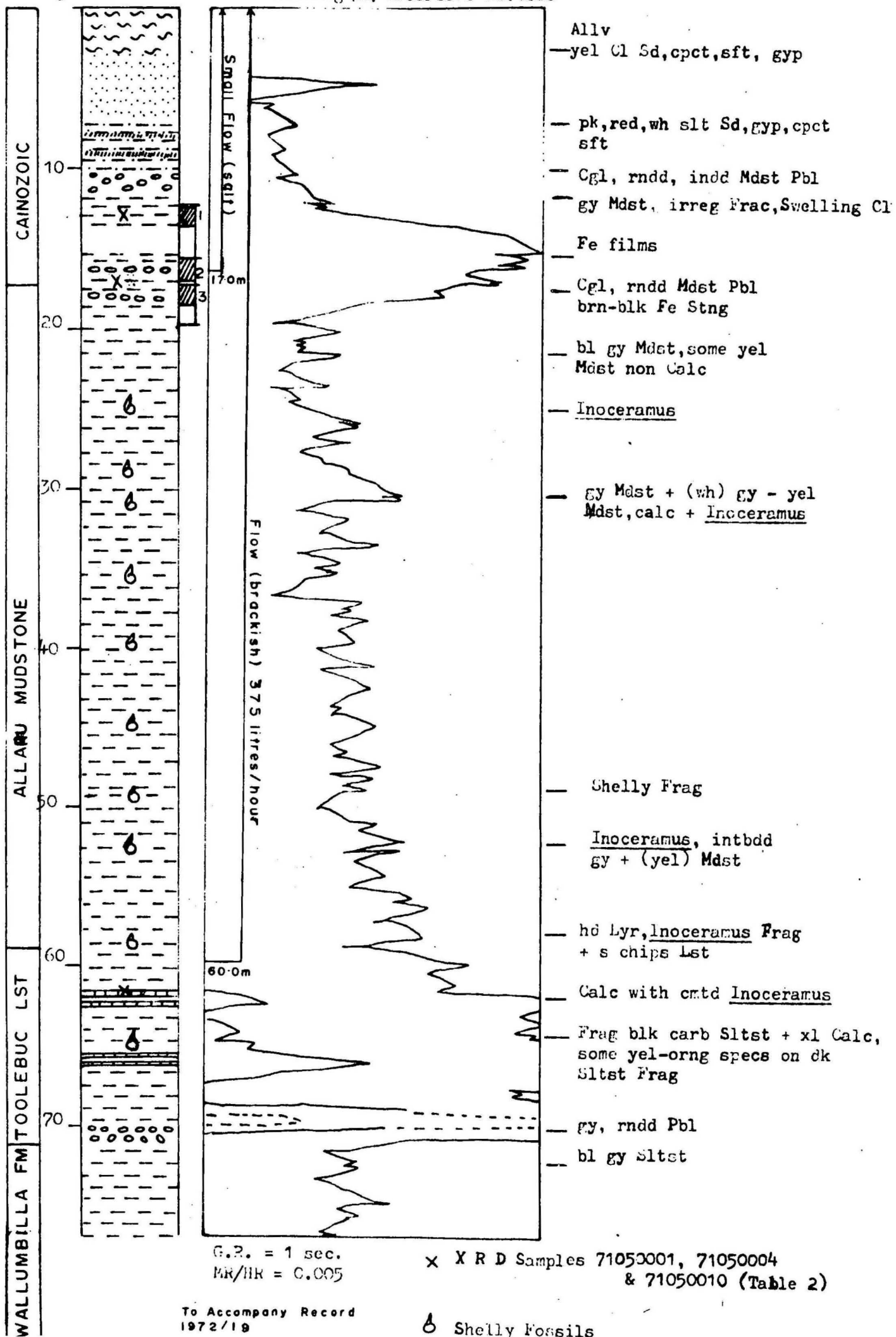


TABLE 2 - X-RAY DIFFRACTION RESULTS

Analyses carried out in the BMR Laboratories G.E. Berryman, analyst.

Sample No.	Minerals Identified	Depth in metres	Sediment type	BMR Hole No.	Stratigraphic unit
71050001	Dolomite, illite.	12.5	Grey swelling clay	8	Cainozoic
" 0004	Quartz, geothite, illite kaolinite	17.0	Yellow silty-mudstone	8	Cainozoic
" 0005	Calcite, quartz.	50.0	Coquina limestone and black siltstone	6	Toolebuc Limesto
" 0006	Calcite, quartz.	52.0	Black fossiliferous siltstone	6	Toolebuc Limesto
" 0007	Quartz, illite, feldspar, kaolinite, muscovite.	12.0	Yellow-grey sandy siltstone	7	Cainozoic
" 0008	Quartz, jarosite*, illite, kaolinite.	14.0	Yellow-grey siltstone	7	Cainozoic
" 0010	Quartz, illite, calcite, kaolinite, feldspar.	64.0	Black mudstone with yellow oxide	8	Toolebuc Limesto
" 0011 ⁺	Alunite*, quartz.	Surface	White siliceous mudstone	-	Allaru Mudstone
" 0012 ⁺	Svanbergite*, quartz.	Surface	White siliceous siltstone	-	Allaru Mudstone
" 0015 ⁺	Quartz, svanbergite*, kaolinite, illite.	1.3-3.0	Svanbergite?	2	Allaru Mudstone
" 0016 ⁺	kaolinite, quartz, illite.	3.0-4.5	Svanbergite?	2	Allaru Mudstone

*Svanbergite - $2\text{SrO} \cdot 3\text{Al}_2\text{O}_3 \cdot 2\text{SO}_3 \cdot \text{P}_2\text{O}_5 \cdot 6\text{H}_2\text{O}$. (Dana, 1966).

*Jarosite - $\text{K}_2\text{Fe}_6(\text{OH})_{12}(\text{SO}_4)_4$ (" ").

*Alunite - $\text{K}_2\text{Al}_6(\text{OH})_{12}(\text{SO}_4)_4$ (" ").

+Major element analyses listed in Appendix 1.

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APPENDIX 1

Chemical Analysis of Samples from
the Springvale Area

by

J.W. Sheraton

Four samples from the Springvale area, were submitted for major element analysis by X-ray fluorescence, using material ignited at 900°C.

Two samples (Nos 71050012 and 71050015) contain svanbergite, identified by X-ray diffraction (see Table 2). This mineral is a phosphate and sulphate of aluminium and strontium and its presence accounts for the low totals for these two samples. Similarly, sample 71050011 contains alunite and would therefore include a significant percentage of sulphur.

Sample No.	71050011 ⁺	71050012 ⁺	71050015 ⁺	71050016 ⁺
SiO ₂	17.8	6.3	51.7	51.5
TiO ₂	0.04	0.17	0.89	0.89
Al ₂ O ₃	28.6	30.8	20.2	18.73
*Fe ₂ O ₃	1.70	0.13	1.64	1.38
MnO	0.01	0.02	0.01	0.01
MgO	0.1	0.1	1.0	0.7
CaO	0.14	1.77	1.99	3.89
Na ₂ O	0.3	0.2	0.5	0.4
K ₂ O	7.61	0.25	0.88	0.76
P ₂ O ₅	1.57	17.8	0.82	0.05
Loss on ignition	37.86	20.86	17.55	16.93
	95.7	78.5	97.2	95.2

* Total iron as Fe₂O₃

+ X-ray diffraction analysis listed in Table 2.