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RECORDS:

1964/69

REPORT ON CORE HOLE GRG.14, GEORGINA BASIN, AND CORRELATION WITH GRG. 4.

by

R.A.H. Nichols and A.E. Fehr (IFP)

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Records 1964/69

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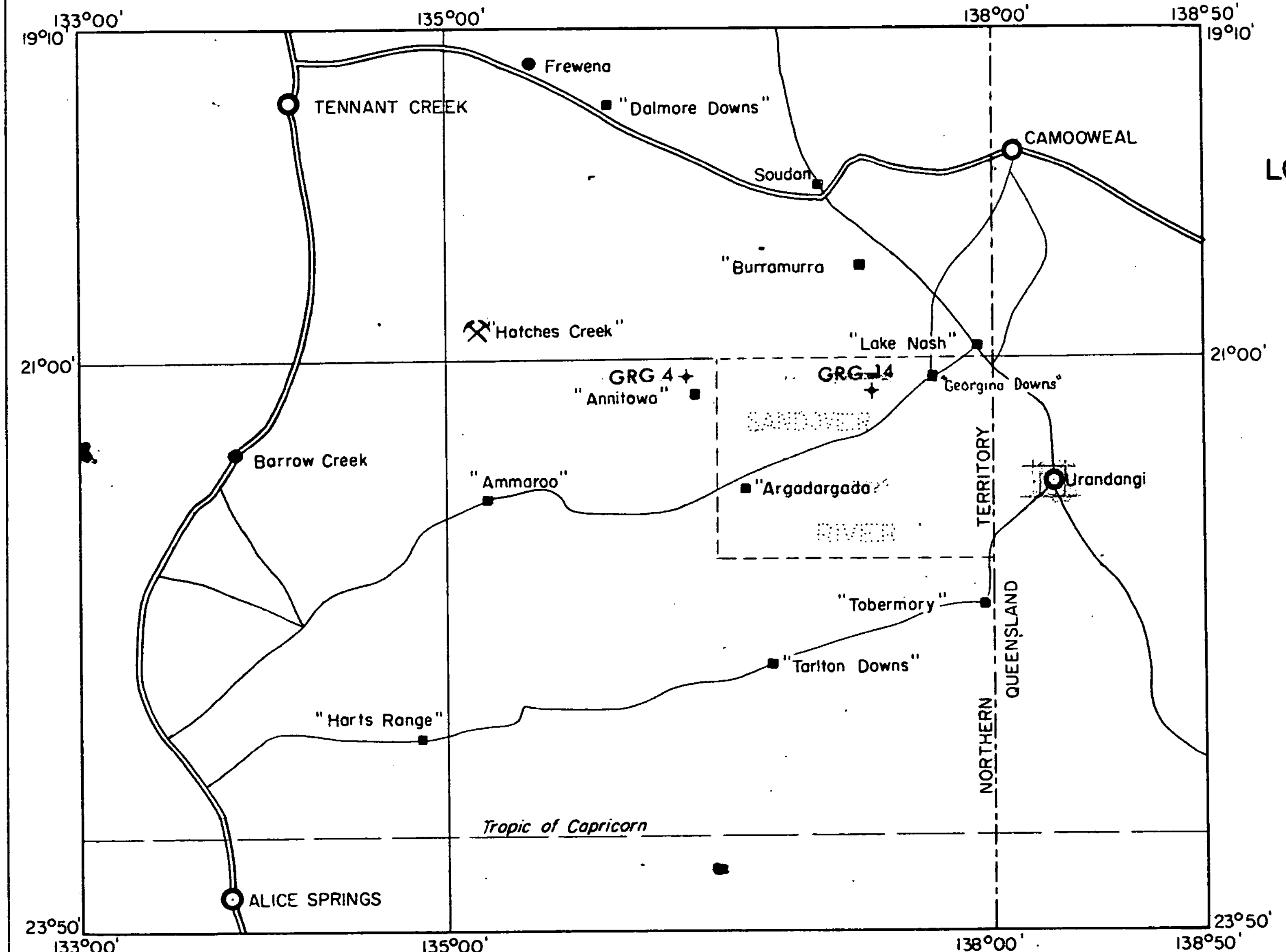
Fig 1



LOCALITY MAP OF CORE-HOLES GRG. 4 and GRG. 14 NORTHERN TERRITORY

REFERENCE

	Towns		Homestead
	Bitumen		Sheet area boundary
	Unsealed roads		Hotel and filling station
GRG. 4	Core hole		

SCALE

32 0 32 64 96 128 160 Miles

Bureau of Mineral Resources, Geology and Geophysics March, 1964

To Accompany Record No 1964/69

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NT/A/77

REPORT ON CORE HOLE GRG.14, GEORGINA BASIN AND CORRELATION WITH GRG.4.

INTRODUCTION

Core-hole GRG.14 is situated on the Sandover River Sheet area, Northern Territory (Fig.1), and was drilled during the Bureau of Mineral Resources core drilling programme in the Georgina Basin. It is situated 64 miles east of GRG.4, examined by Fehr and Nichols (1963). The results of the core drilling programme are recorded by Milligan (1963).

The Georgina Basin is situated in the Northern Territory and Queensland, and consists of Lower Palaeozoic sedimentary rocks, predominantly carbonates. The basin is surrounded by Precambrian sedimentary, igneous and metamorphic rocks which crop out along the southern, eastern and western margins. The northern margin is covered by Mesozoic rocks. The region is largely covered by sand and soil, and outcrops have been ferruginised and silicified.

The core drilling programme was planned to obtain unweathered sections which would enable correlation with known outcrop geology; to investigate reservoir beds for petroleum, and aquifers in areas not suitably watered, and to recover samples of the softer units in the sequence. Core-hole GRG.14 was sited near the Sandover River to determine the subsurface nature of the northern extensions (towards the Barkly Tableland) of the carbonates and underlying rocks which range from Lower Cambrian to Lower Ordovician.

Dolutites, pelletal and intraclastic dolarenites and dolrudites, with interbedded quartz sandstones crop out on Scarr Hill, two miles south of the site. They form part of the Meeta Beds, thought to be Middle or Upper Cambrian in age (Nichols,1964).

GRG.14 was continuously cored to 720'4" (recovery 85%). Diagnostic fossils were not found and the sedimentary petrology was studied in detail to find a means of correlation between GRG. 14 and GRG.4.

The cores were examined by A.E. Fehr (IFP), R.A.H. Nichols (BMR) and M. Arman (BMR). R.A.H. Nichols and A.E. Fehr prepared the record; the former compiled the enclosed log while the latter completed a detailed examination of the insoluble residues.

TECHNIQUES

Narrow, continuous strips along the cores (117' 6" - 720' 4"), were planed and polished with carborundum. This quick method provides clean surfaces for initial observation.

The cores were then washed and examined in the wet state with a hand lens, hydrochloric acid and a steel needle. Intervals of macroscopically, uniform lithologies were measured; representative samples (1"-8" long) were chosen from each lithology and from thin interbeds when considered significant. The cores were sawn lengthwise in two, and one half was ground and polished. The other half was used for thin section preparation, and insoluble and calcilog powders.

The core samples were mounted horizontally on glass plates; the surfaces were etched with dilute hydrochloric acid (10% cold), and varying degrees of effervescence were noted.

The surfaces were washed and then covered with a solution of Alizarin red S; calcite turned red, pure dolomite remained unstained, and ferrodolomite turned purple (Warne, 1962). They were not treated with a mixture of hydrochloric acid and potassium ferricyanide as the Alizarin red S stains indicated the presence of ferrodolomite.

Thin sections were made from significant lithologies and were preferred to peels, as maximum clarity and optical properties were required for mineral and fossil recognition.

All lithologies were subjected to calcimetry (Bastian, 1962). In order to give the ratio of limestone to total carbonate for each lithology, thin slices of core perpendicular to bedding, were crushed to a consistent grain size of 0.012 - 0.024 inches. The rock powder was dissolved in cold hydrochloric acid (10%), and the amount of carbon dioxide lost after 1 and 9 minutes gave the nearest value to the actual ratio of limestone to total carbonate.

The residues, obtained from dissolving one gram of the remaining powder in warm hydrochloric acid (10%), were dried, and their quantity and mineralogical composition were determined under a binocular polarizing microscope.

Determination of the strontium and phosphate content is being carried out by the Australian Mineral Development Laboratories, Adelaide. If samples can be sent from the different lithologies in each core-hole, the results may provide a valuable means of correlation. This is a costly, and possibly a long method of analysis, but may be useful if the present type of study, which took two and a half months, is unsatisfactory.

REPRESENTATION AND RESULTS

A study of carbonate rocks involves the application of all the principles used in the study of non-carbonate clastic, organic and chemical rocks, and a realisation that textural variations are produced by the different specific gravity and morphology of the organic and clastic grains. A greater variety of diagenetic processes modify textures more in carbonate rocks than in other sedimentary rocks.

An attempt has been made to show all the observed properties of the rocks using blocks and symbols (Enclosures 1 and 2). The information is plotted in several columns on both sides of the lithological log in order to illustrate the variation of rock properties with depth. Some columns represent quantitative analyses, e.g. grain size, cacite/ total carbonate ration; others represent qualitative analyses, e.g. structures, and colour.

On large scale logs, the present pictorial graphic approach is preferred to the use of black rectangles under a symbol at the head of the column (Bouma, 1962), as the latter method necessitates continual reference to the explanation at the top of the log. However, on small scale correlation logs, black rectangles and bars enable easier recognition of vertical and lateral changes of parameters. In the following sections the various columns used in the graphic log are explained.

CORE RECOVERY

The core-hole was drilled in hard dolomite which resulted in good core recovery (85%). Variations in grain size or porosity did not reduce the percentage of recovery. Core loss occurred mainly between 120-230 feet due to many clay interbeds, and possibly chemically weathered rocks immediately below the superficial sediments.

GRADE SIZE

Three classes of grade size were distinguished: Lutite; $<$1/16 mm., clay and silt size, and microcrystalline. Arenite; 1/16 - 2mm., sandsize and medium crystalline. Rudite; $>$ 2 mm., microconglomeratic and coarse crystalline. Each grade size column represents the range of particle size, or a uniform particle size within a certain range. Smaller grade size subdivisions were considered unreliable as grade size can be altered by diagenesis.

Most of the carbonates in GRG. 14 are dolutites but interbeds of medium crystalline dolomite, pelletal and intraclastic dolarenites and dolrudites occur throughout the core-hole. Quartz silt and sand is also present at intervals throughout.

117'6" - 251' : Lithologies are predominantly of lutite grade, with interbeds of lutite-arenite grade.

251' - 443' : Lithologies are predominantly mixed lutite-arenite-rudite grades with interbeds of lutite.

443' - 720' : Lithologies are predominantly lutite grade, with interbeds of lutite-arenite grade, and several interbeds of medium crystalline dolomite.

RESIDUES

A detailed investigation of the insoluble residues is justified as the sequence is composed entirely of dolomite.

Residues from every lithological interval were studied in clove oil with a polarizing microscope at a magnification of X 80.

Heavy Minerals

Tourmaline is by far the predominant, ubiquitous accessory. In intercalations with quartz sand admixture it often occurs as large, rounded, transported, brown grains, whilst in clays it occurs as small, bluish prisms, probably of authigenic origin.

Zircon is much rarer, and is rounded, often having a frosted surface. It occurs sporadically from 117'6" - 615' with slight concentrations from 440'-450', 577'-615' and especially at 484'-492'. Generally, it is associated with quartz sand.

Pyrite occurs in recognisable amounts in a few places from 410' downwards; cubic crystals were found at 650' and 656'.

Traces of a light green mineral, possibly epidote, were observed at 205'.

Light Minerals

In considering the total amount, at least two intervals can be recognised:

117'6" - 240'; light minerals form $<$ 10% of rock.
240' - 720'4"; light minerals form $>$ 10% of rock and often $>$ 25%.
Within the latter, further subdivision may be recognised:

240' - 580'; a great proportion of light minerals $>$ 25% of rock.
580' - 685'; a small proportion of light minerals $<$ 25% of rock.
685' - 724'; many light minerals $>$ 50% of rock.

Quartz occurs mainly as fine sand with subrounded grains; decreasing sizes show more pronounced angularity. Overgrowths, or other diagenetical modifications, were not observed. Although ubiquitous, well sorted quartz sand admixture is particularly frequent from 248'-348'. Silt size quartz is mainly associated with clay.

Quartz also occurs as swarms of tiny authigenic prisms at several horizons in pure dolomite with small residues. Slightly increased frequences from 471'-613' and 187'-342' show no relationship to lithology or structures, but in some cases, the presence of organic matter, or silicification, seems related to the authigenesis of quartz.

Chert forms white patches or beds from 562'-720'4" and is very rare from 118'-562'.

Chalcedony forms rosettes, which include many impurities, e.g. at 290', 318', and 565'.

Microcline occurs in nearly all the residues and usually ranges from 5-10% (of residue). With increasing quartz sand content, microcline increases to 30%. Its size is similar to quartz, rounding is generally better, and grains often have overgrowths of fresh indented microcline of slightly different optical orientation. Plagioclase was not observed.

Clay, possibly illite, forms fine laminae or is finely disseminated. Transitions to subordinate, parallel muscovite flakes (5-10%) are common. From 117'6" - 340', the clay is usually brown and ferruginous and the colour of the dolomite is light brown. From 340' - 720', the clay lamellae are dark grey and the dolomite is medium grey.

Clay interbeds occur between 128'-141', and abundant clay residues were found from 464' - 557'. The small residues from 117'-6" - 240' also consist of clay.

Glauconite is present as rare grains of silt size. They are too small to allow determination of their origin (i.e. detrital or authigenic). Very thick intervals with glauconite occur from 545'-550', and from 640'-650'; the mineral is more sporadic from 118'-545'. Usually it is associated with clay or silt.

Asphalt was observed as rare, solid impregnations with conchoidal fracture in the lower part of the core-hole (564' - 720'4"). The organic material occurs in cavities in the same interval as diagenetic silica; this suggests secondary introduction.

LITHOLOGY LOG

The major rock types are represented in this column by the major rock symbols. Important constituents, e.g. pellets, intraclasts and ooliths are also represented.

Occasionally, several thin, interbedded lithologies are represented by two interbeds. In these cases, the interbeds do not occur at the intervals shown, but occur between the upper and lower limits. In order to present a more detailed analysis of GRG.14, and to provide a comparative scale of logging with GRG.4, few lithologies were integrated on the log.

Synopsis of lithologies

1. Limestone does not occur.

2. Dolutite is predominant and is slightly ferruginous (possibly limonitic from 117'6" - 384'.

3. Pelletal and intraclastic dolarenite beds* occur throughout but are more abundant from 181' - 490'.

4. Pelletal and intraclastic dolrudite beds* are more frequent from 180' - 275'.

5. Oolitic dolarenite beds are rare and occur from 291' - 296', at 397', 571' and 715'.

6. Quartzose dolomite beds occur throughout, but are more frequent from 240' - 720'4".

7. Quartz sandstone occurs at 332', 576' and 706'.

8. Quartz siltstone occurs at 592'.

9. Shale occurs from 350' - 353' and at 371'.

10. Clay occurs from 128' - 141'. Thin clay laminae occur throughout, often along stylolites.

11. Chert occurs as nodules and lenses in 12 thin intervals between 406' - 715', but is more abundant between 562' - 715'.

CALCIMETRY LOG

The total carbonate value should be complementary to the total insoluble residue value. However a sum differing from 100% is explained by the different methods used in their determination. For example, the percentage of carbonates is calculated from the amount of effervescing carbon dioxide which varies with temperature and pressure, and the amount of insoluble residue is determined by weighing. Furthermore, loss of carbon dioxide is only calculated for 9 minutes; consequently solution is incomplete.

Although limestones are absent in GRG. 14, calcareous dolomites can be determined by calcimetry, e.g.

150' - 340'	$CaCO_3$	is 5 - 10%
340' - 600'	"	" 0 - 5%
600' - 720'4"	"	" 5 - 15%

The total carbonate content also decreases from 340' - 565', due to the increase in residues.

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* grains occur in a lutite matrix.

STRUCTURES AND TEXTURES

A variety of structures and textures were observed throughout the core hole. In order to avoid an overcrowded log, they were divided into:

Sedimentary: i.e. primary, which formed during deposition.
Diagenetic : i.e. secondary, which originated after deposition.

Grouping of the structures and textures is not always possible as many primary types may be partly or completely destroyed by diagenesis. For example, partly recrystallised current-or ripple-laminae and algal layering were distinguished under the microscope by the presence or absence of clastic grains and flocculence. Other structures and characteristics however, could be presented objectively regardless of origin, e.g. vugs and ferruginous dolomite. The quartz sand symbol is included in the sedimentary structure column to show its relationship to sedimentary structures.

A) Sedimentary structures and textures

(a) Bedding. Almost every core shows bedding, but it is revealed in different ways, i.e. change in grain size, grain composition, and concentration of grains (e.g. clastic grains of quartz, pellets etc., clay, and changes in crystal size of dolomite). Stylolites may also indicate bedding and often coincide with changes in lithology. In uniform lithologies, thin undulating laminae may result from loadcasting, a late stage of stylolitisation, or possibly ripple-bedding. Bedding planes and changes in lithology are frequent between 248' - 282'; 312' - 450'; 473' - 493'. This indicates variable conditions during the deposition of these beds.

(b) *Scour and fill occurs at 49 horizons; 41% are concentrated between 270' - 396'. (Enclosures 3 and 4).

(c) *Current bedding occurs at 12 horizons; 67% occur between 235' - 477' (Enclosures 3 and 4).

(d) Slumping occurs at 35 horizons; 67% occur between 505' - 720'4" (Enclosures 3 and 4).

(e) Fractured beds and Tension veins occur at 33 horizons; 50% occur between 245' - 357'. Tensions veins seem to have formed penecontemporaneously, possibly by gravity sliding, and were filled with sediment from the bed above. A strong development of tension veins may result in the fractured beds seen in the cores.

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* The above structures coincide at 6 horizons; 5 occur between 270' - 430'.

(f) Load casts, Boudinage, Lenticular beds, Lenses.
Load casts occur at three horizons; with 66% between 549' and 677'.
Boudinage (Ramburg, 1955) structures occur at five horizons; 60% occur from 549' - 677'.
Lenticular beds occur at five horizons; 100% occur from 549' - 677'.
Lenses occur at 17 horizons irregularly throughout the section, and generally represent localised accumulations of quartz sand and silt, or result from infilling and compaction, boudinage or gliding.

The above structures are isolated at certain horizons, but they may be related to, or developed from, each other.

(g) Injection veins. These structures show beds with vertical veins containing sediment from underlying beds. Examples occur at 331', 398', 408' and 549'.

(h) Ripple marks. Definite ripple marks occur at 684'. The small diameter of the core prevented positive identification on occasions, e.g. it is difficult to distinguish ripple marking from partly recrystallised algal layering at 581' and 618'.

(i) Graded bedding was only observed at 552' in quartz silt beds.

(j) Pellets, Intraclasts, Ooliths. The textures produced by these grains may be important criteria for correlation. Pellets and intraclasts occur throughout and generally form beds 1/2 inch to 3 feet thick. They may be densely packed or scattered in these beds.

Pellets occur at frequent intervals, and are generally 0.2 - 1.5 mms. in size; they do not show internal structure and are composed of dolutite. Some are oval, some are squashed or broken. The absence of organic remains in the cores may preclude a faecal origin in situ for these pellets. However, some may be transported faecal pellets, or rounded fragments of eroded dolutites, and form intraclasts.

Intraclasts are generally larger, i.e. 1-2.5 mms., compound grains with more variable shape than pellets. They may be derived by reworking of partly consolidated dolomites or limestones, or by aggregation and agglutination (Illing, 1954; Folk, 1959). Larger fragments, 2.5 mms., form the conglomeratic and breccia horizons.

Ooliths are rare in the sequence and occur from 291' - 295'; at 397', 572' and 715'. (Enclosures 3 and 4).

B) Diagenetic structures and textures

These structures and textures may be related to original conditions during deposition and hence could be useful in correlation under some circumstances. However, in the present case they are not considered valid criteria as they are secondary and not confined to any particular lithology.

(a) Dolomitisation. Most of the sequence consists of dolomite. In many cases the sedimentary structures and textures are preserved which may indicate penecontemporaneous dolomitisation or primary precipitation. Medium and coarse crystalline dolomite occurs at several horizons and may indicate later dolomitisation or recrystallisation.

(b) Flocculence and Recrystallisation

(i) Grain growth mozaic. There are many irregularly shaped areas of variable size, composed of medium to coarse crystalline dolomite in microcrystalline dolomite. These areas are a result of recrystallisation by grain growth, and are distinguished by variable crystal size and shape, irregular denticulate boundaries with the matrix, and replacement features (e.g. algal layers interrupted by medium crystalline mosaic of dolomite.

(ii) Infilled cavities. These structures may have resulted from internal solution or erosion in the semi-consolidated state, or may have developed from areas of trapped gas in soft dolutite. They are characterised by drusy and coarse anhedral crystalline mosaics. The drusy mosaic of dolomite may have resulted from early replacement of calcite or from direct precipitation,

(c) Silicification. Lenses, nodules and thin beds of chert occur at 14 horizons from 290' - 715'; 78% occur from 564' - 715'. Cryptocrystalline silica seems to be secondary and has replaced microcrystalline, pelletal and oolitic dolomite or limestone. It was derived either from within the sediments or from percolating solutions.

(d) Ferruginisation. The dolomites at the top of the sequence (117'6" - 384') are very light brown (buff) in colour, and Liesegang banding is common (American Geological Institute 1962). The iron oxide may be limonite, and often gives a mottled appearance. The boundary with non-ferruginous parts is oblique to bedding.

(e) Stylolites. Stylolites occur throughout the sequence but are more frequent in some parts. They may be highly crenulated, with high amplitude and often truncate sedimentary structures and pellets, and displace laminae. Others are of low amplitude and undulating. Quartz silt and sand, and clay may be concentrated along stylolites, forming the insoluble residue after pressure - solution within the rock.

(f) Vugs, Pores, Fissures. These features occur throughout the sequence, but fissures are rare. The vugs are lined with drusy dolomite, which may have been precipitated from solution, or with calcite. Rod and star-like vugs may have contained fibres of gypsum before leaching. Vugs and fissures are a result of solution and possibly internal erosion in the solid state.

(g) Veins. These are fractures in the rock filled with medium crystalline calcite; they truncate sedimentary and diagenetic structures, and are considered to represent the latest stage in diagenesis.

PALAEONTOLOGY

There are very few fossils in GRG.14 and the majority appear to be layered algae and stomatolites, with flocculent layers between cryptocrystalline dolomite layers. The attitude of the layers varies from horizontal and undulating with some truncated layers, to vertical within a column. They occur mainly between 297' - 498' and 568' - 720'4".

In thin section, other types appear: e.g. at 396', a variety with thin walls? and cellular appearance similar to Stromatactis (Bathurst, 1959); and some possibly unicellular organism, with a thin wall? of cryptocrystalline dolomite surrounding a core of medium crystalline dolomite (319' - 422').

Burrows are included under "Palaeontology" because they are evidence of organic activity; they occur mainly in the lower half of the sequence. They cannot always be deciphered, as diagenesis may have destroyed the interior texture and the boundaries with the host rock.

COLOUR

Colour is determined from the wet cores and is represented diagrammatically by "hue" and "darkness" on the log. A blank "hue" column means a grey colour. Colours vary from light to medium grey and brown. The sequence is predominantly light brown from 117'6" - 390' (slight ferruginisation), and varies from light to medium grey and brown from 390' - 720'4".

LITHOLOGICAL DESCRIPTIONS

Brief descriptions are added to summarise the essential features, and to provide supplementary information.

CORRELATION BETWEEN GRG.14 AND GRG.4

Although algae are present in GRG.4, and subsequent examination of thin sections revealed Echinodermata fragments, similar and diagnostic fossils were not found during this study of GRG.14. However, correlation with GRG.4 is effected by a comparison of the frequency of certain sedimentary textures and structures, and the distribution of insoluble residues (Enclosures 3 and 4).

Correlation based on limestone and dolomite intervals seems impossible at present, for, although limestone occurs in GRG.4 and Lake Nash No.1 (40 miles east of GRG.14), it is absent in GRG.14. Consequently, the frequency and thickness of pelletal and intraclastic, oolitic, conglomeratic and breccia textures were plotted in separate columns for GRG.4 and 14. The frequency of sedimentary structures, e.g. current bedding, scour and fill and slumping, and insoluble residues, e.g. quartz, tourmaline and zircon were also plotted in a similar manner. These parameters were chosen on the assumption that they might be persistent between the core-holes, and that they would indicate environmental conditions. Certain intervals in the distribution of the following parameters were recognised and correlated in each core-hole, e.g. interval A - A, in the distribution of pellets and intraclasts in GRG.4 was compared with interval A-A_1 in GRG.14, point A in GRG.14 being 200 feet structurally below point A in GRG.4. Similar intervals, e.g. B-B, (ooliths), C-C_1 (quartz) etc, were recognised and correlated as described below.

Pellets and intraclasts. There is a maximum of these grains in the upper parts of GRG.4 and 14, divided by minima from lower order maxima in the bottom parts (Enclosure 3 and 4). The top of the interval with the minimum occurrence (A-A_1) in GRG.14 is 200 feet below the top of a similar minima-interval in GRG.4 (A-A_1).

The greater frequency and thickness of pelletal and intraclastic horizons in GRG.14 indicates higher energy conditions than in GRG.4, possibly associated with shallower water. Alternatively, some pellets etc, may be a result of scavenging action.

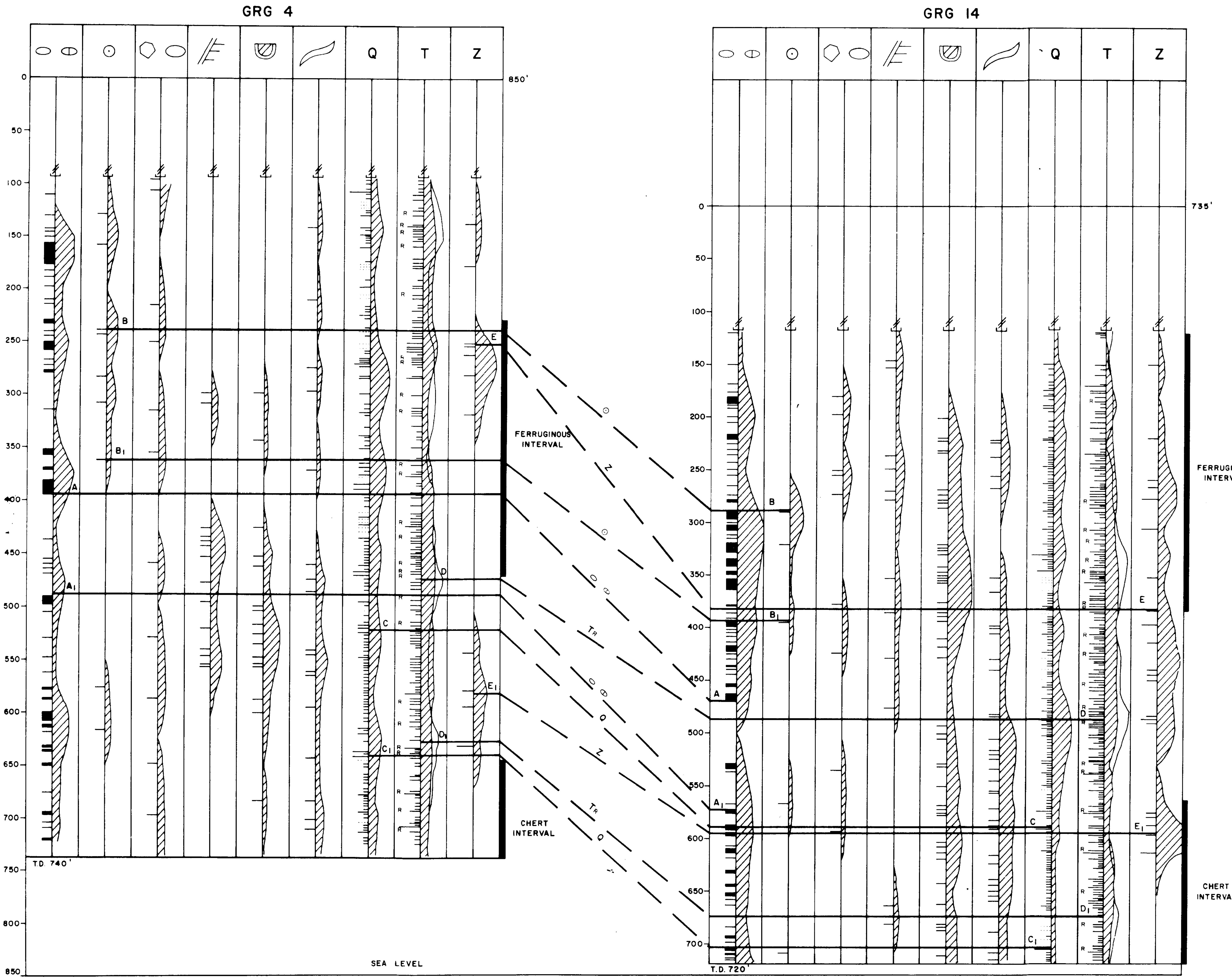
Ooliths. These grains may be unreliable criteria for correlation, as they are rare in both core-holes. They are relatively frequent in the upper parts, separated by large non-oolitic intervals from lower parts, poor in ooliths. The top of the non-oolitic interval (B-B_1) in GRG.14 is 150 feet below the top of a similar non-oolitic interval in GRG.4 (B-B_1).

Breccias and conglomerates. There is no correlation between the breccia and conglomerate intervals in GRG.14 and 4. In GRG.4, these horizons are thin and occur at regular intervals; in GRG.14, they are more frequent in the upper half. Here, they may be associated with higher energy conditions (cf. abundance of pellets).

Current bedding, scour and fill and slump structures. It is impossible to correlate between the two core-holes, using the above structures, as comparable groups do not occur. Current bedding is more frequent in the upper half of GRG. 14, while scour and fill slumping are more frequent throughout GRG.14, where conditions were presumably more turbulent and possibly unstable (e.g. gravity slumping and/or slight earth tremors).

Quartz. The distribution of detrital quartz sand horizons provides a parameter for correlation. Comparable quartz-free intervals were observed (C-C_1) in both GRG.4 and 14, overlain by

FIG. 2



COMPOUND CORRELATION LOG FOR GRG 4 and 14

GEORGINA BASIN N.T.

(DATUM SEA LEVEL)

LEGEND

Superficial deposits
Pellets and intraclasts
Ooliths
Breccia and conglomerates
Current bedding
Scour and fill
Slumping
Q Quartz sand (detrital)
Quartz silt (detrital)
T Tourmaline (total)
R Tourmaline (rounded detrital)
Z Zircon
Sample point
Occurrence
Medium abundance
Strong abundance
Frequency distribution curves per 50 feet with 50% overlap
Frequency distribution curve for rounded tourmaline
0 5%
735' Height above sea level
T.D 720' Total depth 720'

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To accompany Record 1964/

beds with more frequent quartz horizons. The latter do not always form comparable groups. Quartz silt horizons have been plotted where abundant throughout an interval, and concentrations occur from 410' - 430', in GRG.4, and from 350' - 365' in GRG.14.

Two distinct intervals containing authigenic quartz were observed from 550' - 650' in GRG.4 and from 214' - 342' in GRG.14, but when compared, the correlation lines crossed those of other parameters. The small amount of silica and the secondary nature of crystallisation probably caused the erratic distribution of euhedral quartz.

Chert occurs in both core-holes; from 650'- 740' in GRG. 4 with isolated occurrences at 523' and 582', and from 562' - 715' in GRG.14 with isolated occurrences at 406' and 443'. The chert intervals occur in the lower parts of each core-hole, but correlation lines from the top of main intervals (the base is not known) cross those of other parameters. The silica was either primary silica from within the sediment, or was precipitated from percolating solutions, later remobilisation and concentration led to the development of chert nodules and beds.

Tourmaline. Tourmaline is the most common accessory mineral in both core-holes, but there is more authigenic tourmaline in GRG. 14. Two curves are shown, representing the distribution of total tourmaline and of detrital tourmaline. The curve for detrital tourmaline in GRG.4 is hypothetical, and was extrapolated from the distribution curve for sand grade detritals. It was not possible to correlate between points on the total tourmaline curve, but a tentative comparison was made between the maximum occurrences ($D-D_1$) of detrital tourmaline in the lower part of each core-hole.

Zircon. In GRG.4, zircon occurs in two groups; the upper group contains more horizons. In GRG.14, this grouping is not as clear, but a tentative correlation can be made between intervals of maximum occurrence ($E-E_1$).

Occurrences of other minerals

Ferruginous dolomite occurs in the upper parts of both core-holes; the iron oxide content is much higher in GRG.4 and gives the rock a red-brown colour. In GRG.14, the iron content is lower, the colour is light brown, Liesegang rings and bands, and cross-cutting boundaries occur. In GRG.14 the main interval is from 117'6" - 335'; in GRG.4 it is from 226' - 464'. A correlation line from the base of the ferruginous intervals crosses other correlation lines. The iron oxide seems to be in a primary position in GRG.4, whereas it was probably redistributed during a late stage in diagenesis in GRG.14.

Glauconite seems to be present only in GRG.14, and Biotite only in GRG.4.

Asphalt is present in GRG.14 in vugs and fissures, whereas bituminous material may be finely disseminated in the medium grey intervals in the lower part of GRG.4.

CONCLUSIONS

Parameters which gave the most consistent results in correlation between GRG.4 and 14 were the distributions of pellets and intraclasts and detrital quartz. The distribution of ooliths, detrital tourmaline and zircon provided supporting evidence.

The comparable intervals in GRG.14 are between 170' and 200' structurally lower than corresponding intervals in GRG.4.

Although the parameters do not give consistent results throughout the core holes, the variations are attributed to variable rates of deposition. The parameters appear to be the only ones available from the present cores and the correlation is thought to be correct. However, as there are only two wells, 64 miles apart, the results cannot be regarded as conclusive. Deeper drilling and more closely spaced core holes should provide more evidence and control.

The total percentage of insoluble residue is lower in GRG. 14 than in GRG.4, e.g.

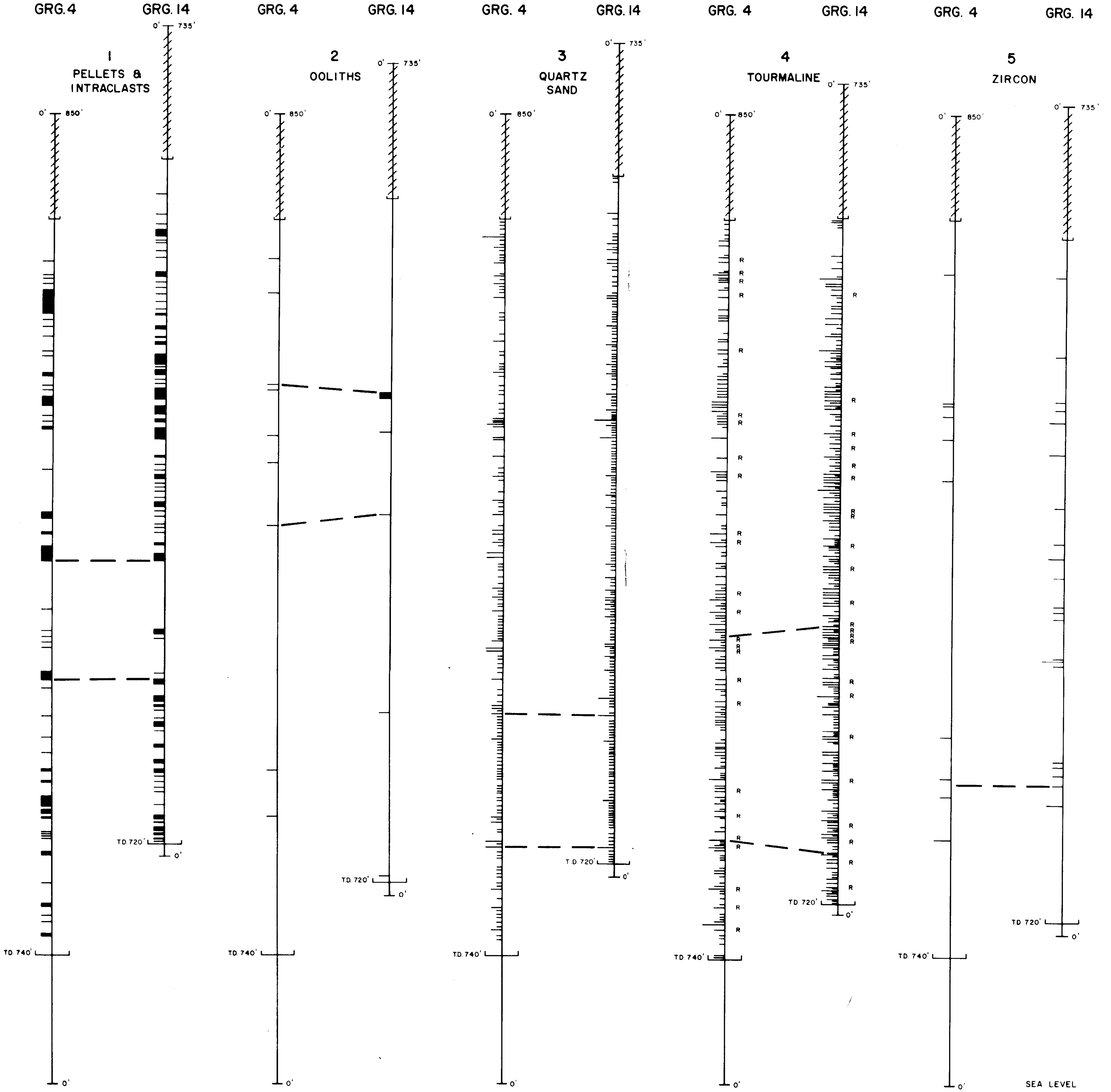
GRG.4 36% of the studied samples contain > 25% residue.
GRG.14 14% of the studied samples contain > 25% residue.

The percentage probably decreases with distance from the basin margin and may indicate that GRG.14 was further from a western source area. In GRG.14 however, the decrease in total percentage contrasts with a higher percentage of authigenic tourmaline and zircon, and this may be due to derivation from different source areas and variable current strength.

FIG. 3

CORRELATION LOG FOR EACH PARAMETER IN GRG 4 & 14

(DATUM IS COMPARABLE INTERVAL IN EACH CASE)



LEGEND

Superficial deposits

Sample point

Occurrence

Medium abundance

Strong abundance

R Rounded detrital tourmaline

0 50 Scale in feet (vertical)

T.D. 740' Total depth

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JdH

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BMR Core Hole Grg. 14

(Georgina Basin)

137° 15' 46" E
21° 10' 32" S
El. 730'

Scale = 1 inch : feet

Sandover River
1:250,000 Sheet SF 53-8

Geologists: A. E. FEHR (IFP)

R. A. H. NICHOLS (B.M.R)

Drawn by: J. G. A. DEN HERTOG

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Bureau of Mineral Resources, Geology and Geophysics. To accompany Record 1964/69

LEGEND

Lithologies

- Clay
- Dolomite
- Dolomite (pelletal, quartz sand, etc)
- Dolomite (silty)
- Sandstone (quartz)
- Shale
- Chert

Residues

• • •	Sand	Quartz
· · · · · ·	Silt	Quartz
I I I	Euhedra	Quartz
~~	Chert	
+ + +	Microcline	
= = =	Clay (muscovite)	
Bit	Bitumen	
T(r)	Tourmaline (rounded)	
(T) I	Tourmaline trace, abundant	
Z	Zircon	
G	Glauconite	
P	Pyrite	
E	Epidote	

Calcium Carbonate Content

Total Carbonate Content

Structures & Textures

Sedimentary

- Slumping
- Load cast
- Scour and fill
- Pellets
- Intraclasts
- Ooliths
- Conglomerate
- Breccia
- Fractured beds or laminae
- Boudinage
- Ripple marks
- Current bedding
- Planar bedding
- Wavy lamellae
- Lens
- Lenticular bed
- Tension vein
- Injection vein

Diagenetic

- Stylolites
- Vugs, pores
- Dolomite, recrystallised
- Calcite, recrystallised
- Patches, flocculence
- Silicification
- Ferruginisation (slight)
- Pyrite
- Fissures
- Veins
- Solution planes

Organic

- Fossil bioclast
- Algal mat
- Burrow