BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD

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Stratigraphic Drilling in the Georgina Basin
Burke River Structural Belt
August 1986 - January 1987

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Summary

Four fully cored stratigraphic holes were drilled in the Burke River Structural Belt and Ardmore Outlier in the eastern Georgina Basin between August 1986 and January 1987. The stratigraphy of these holes, their principal lithological components, and palaeontological determinations are described in this record. Phosphatic sediments were intersected in the Thorntonia Limestone, Beetle Creek Formation, and Inca Formation. Organic-rich sediments with TOC values up to 6% were encountered in the Beetle Creek Formation, Inca Formation and Devoncourt Limestone. Oil stains were common throughout the cores, usually in association with fracture porosity and calcite veins.

Introduction

Between August 1986 and January 1987 a BMR stratigraphic drilling program was mounted in the Burke River Structural Belt and Ardmore Outlier in the eastern part of the Georgina Basin. The program was split into two phases. Phase 1 involved the drilling of three shallow stratigraphic holes by a Mayhew 1000 rig under the supervision of E.D. Lodwick from the BMR. Phase 2 involved the drilling of one stratigraphic hole, and the extension of a previously drilled BMR hole by a Longyear 44 rig under the supervision of D. Astoli from Bresall Pty Ltd. The on-site BMR representatives were Mr K.J. Armstrong, Dr J.R. Laurie, and Dr P.N. Southgate. The drilling was part of the phosphate research project (PHOSREP), an interdisciplinary program aimed at further elucidating the origins of the phosphate deposits of the Georgina Basin.

The aims of the drilling were threefold : 1) to provide a continual lithological sequence through poorly outcropping units; 2) to provide fresh samples for geochemical analysis and; 3) to resolve outstanding stratigraphic problems.

Difficulties involved with drilling in the Middle Cambrian sequences of the eastern Georgina Basin cannot be overestimated. Sediments of the Beetle Creek and Inca Formations are generally very weathered and occur at relatively shallow depths, so that there are few sites where fresh material can be expected. These problems are further compounded by groundwaters which use the phosphate deposits as the principal aquifer in the Burke River Structural Belt. The combination of deep weathering with adjacent lithologies of different coherence (eg. friable and porous phosphorites of the aquifer occur interbedded with fractured cherts and indurated phosphorites at a scale of 2-20cm.) rendered drilling very difficult. In addition to these problems, rapid lateral facies changes in the Beetle Creek Formation, and block faulting, locally providing displacements of up to several hundreds of metres, required that all drill sites be located relatively close to known outcrops, or in structurally uncomplicated areas. With these difficulties in mind, and by using some 20 years of exploration experience, including drilling, supplied by Queensland Phosphate Ltd., (Q.P.L.) it was hoped to select 4 drill sites that would provide fresh samples and good recovery. Previous exploration drilling by Q.P.L. was predominantly by a percussion rig, so that although the area had been drilled on a closely spaced grid, fresh drill core samples and continuously cored intervals were not available. We therefore attribute much of the success of this drilling program to the scientific information and logistical help provided by J.K. Rogers of the Western Mining Corporation (WMC). Accordingly we would like to express our sincere thanks to Mr J.K. Rogers and the staff of Q.P.L. for the assistance they provided throughout this drilling program. The rapid processing of samples by acid etching techniques, necessary for the palaeontological determinations reported herein, were undertaken by Dick Brown.

Duchess 16

Well Index Number 4131

Date Drilled August - September 1986 ; January 1987

Position $21^{o}53'S$ $139^{o}56'E$

Elevation Approximately 279m.

Rig Mayhew 1000 / Longyear 44.

Drilling Open hole drilling to 19m, continuous coring to 88m at which point circulation was lost. Hole was re-entered by Bresall Pty Ltd and extended to 133.30m. Core recovery from 82.0m to 133.30m was generally very poor with an average of 60% core loss (see appendix 4). Drilling was terminated due to continued loss of circulation and poor recovery.

Geologists J.R. Laurie, P.N. Southgate

Supervising Technician K.J. Armstrong.

Objectives To continuously core the Middle Cambrian sequence in the Burke River Structural Belt. To establish the thickness and facies variations in the Inca and Beetle Creek Formations and the Thorntonia Limestone. To provide fresh unweathered samples for geochemical analysis.

Target Mount Birnie Beds

Discussion The hole was sited on the advice of J.K. Rogers from WMC adjacent to a recently drilled percusion hole which yielded chips of black siltstone containing fresh pyrite. This site was the only known place where fresh core could be expected in the Western Shale Zone of the Duchess deposit.

Preliminary Results

Sequence Duchess 16 penetrated :

1) Inca Formation (lowermost 82m of this formation)

2) Beetle Creek Formation 82m-133.3m

Weathering The uppermost 67m of the Inca Formation is weathered to form a bleached white shale. Between 67m and 82m the degree of weathering rapidly decreases, and this is reflected in the colour of the shales, which contain pyrite and vary from dark brown to dark grey. At 82m the sharp boundary between the Inca and Beetle Creek Formations coincides with a change in the degree of weathering. Phosphorites, shales and cherts of the Beetle Creek Formation are variably weathered between 82m and 133.3m, and vary in colour from light tan to black. In this interval the cherts are generally black and the phosphorites tan coloured. In the upper parts of the Beetle Creek Formation an increase in the degree of weathering coincides with the location of the regional groundwater aquifer.

Lithologies Shales in the lower parts of the Inca Formation occur in a series of normally graded laminae which combine to form darkening and fining upward sequences 20cm-80cm thick. Normally graded sedimentation units in the lower parts of these sequences vary from 1-5mm in thickness. Each of these units contains a 1-3mm thick basal interval of fine to medium grained phosphatic wackestone which overlies a scour surface and grades vertically into a finely laminated black mudstone. The upper parts of each fining upward sequence is dominated by finely laminated black mudstone.

Poor recovery in the Beetle Creek Formation precludes any detailed description of the core. Most of the phosphate recovered consists of light grey indurated phosphate with minor friable phosphate in some of the cherts. Black cherts from the Siltstone Member of the Beetle Creek Formation contain fragments of the trilobite *Xystridura* sp.

Duchess 17

Well Index Number 4132

Date Drilled September 1986

Position 21°42'S 139°58'E

Elevation Approximately 300m.

Rig Mayhew 1000

Drilling Open hole drilling to 19.15m. Continuous coring to 84.15m. Recovery in the interval 39m to 60m was generally poor with extensive core loss and intermittent core recovery. Elsewhere recovery was excellent. Drilling was terminated after the target was reached.

Geologist J.R. Laurie

Objectives To continuously core the Middle Cambrian sequence in the northern-most extension of the Duchess Phosphate deposit. To obtain stratigraphic and sedimentological information on the Inca and Beetle Creek Formations and Thorntonia Limestone and provide fresh samples for geochemical analysis.

Target Mount Birnie Beds.

Discussion The hole was sited in the vicinity of Duchess 14, a stratigraphic hole that had failed to reach its target of the Mount Birnie Beds, but had yielded relatively fresh drill core from the Inca and Beetle Creek Formations. The area in which Duchess 14 and 17 are located is extensively faulted, it was hoped that the structural complications encountered in Duchess 14 would not occur in Duchess 17.

Preliminary Results

Sequence Duchess 17 penetrated :

1) Inca Formation (lowermost 39m of the formation,

2) Beetle Creek Formation 39m-56.25m

3) Thorntonia Limestone 56.25m-58m

4) Mount Birnie Beds 58m-84.15m

Weathering Rocks of the Inca and Beetle Creek Formations and Thorntonia Limestone are all variably weathered. Rocks of the Mount Birnie Beds are relatively fresh and unweathered.

Lithologies The Inca Formation consists of white, fissile shale with normally graded laminae and scattered concretions. Phosphorites from the Beetle Creek Formation are dominated by grainstone and packstone textures. Several thin beds and laminae of mudstone phosphorite occur at the top of the formation between 41m and 39m. Although poor recovery and broken core preclude the identification of most sedimentary structures, some larger pieces are characterised by cross bedding. Glauconite and skeletal grains are common in the granular phosphorites. The Siltstone Member of the Beetle Creek Formation occurs between 52.5m and 56.25m as an interval of yellow to white siltstones, pebbly siltstones and conglomerate. At first appearance this interval appears to be a breccia, however the pebbles of dolostone and chert are draped over by siltstone laminae which implies a sedimentary origin and not a tectonic one for these pebbly beds. Beneath the Beetle Creek Formation occurs a 1.75m thick interval of recrystallised dolostone and chert. This interval is assigned to the Thorntonia Limestone. It is floored by a thin horizon of limonite-stained shale and is overlain by a lag deposit dominated by chert and dolostone pebbles of subjacent derivation. The Mount Birnie Beds comprises an interbedded sequence of massive to finely laminated siltstones and mudstones, sandstones, pebbly sandstones and conglomerate. Pebbles in the conglomerate consist of black rock fragments, granite and chert. Quartz and feldspar grains and mudstone intraclasts occur in the sandstones. This core has not been palaeontologically investigated.

Duchess 18

Well Index Number 4197

Date November to January 1986 - 1987

Position 21°45'S 139°59'E

Elevation Approximately 300m.

Rig Longyear 44

Drilling Open hole drilling to 5.90m., drilling to 40.00m with representative 10-20cm lengths of core every 1.0m., continuous coring to 241.55m. Core recovery rate in the continuously cored interval averaged 97.76%. Intervals of core loss, and core run intervals are listed in appendix 4. Drilling was terminated when the Mount Birnie Beds were reached. The hole was drilled at an inclination of 8° from the vertical on a dip direction of 245°.

Supervising Technician K.A. Armstrong

Geologist P.N. Southgate

Objectives To continuously core the Middle Cambrian sequence at Rogers Ridge in the Burke River Structural Belt with the aim of : 1) investigating stratigraphic relationships between the Devoncourt Limestone, Inca and Beetle Creek Formations, and Thorntonia Limestone; 2) assesing the potential of recessive lithologies in all formations as possible source rocks for petroleum and; 3) to test for phosphate in sediments younger than the Beetle Creek Formation.

Target Mount Birnie Beds

Discussion Previous drilling in the vicinity of the Duchess phosphate deposits (BMR Duchess 14,16 and 17) had yielded relatively disappointing results. Sediments belonging to the Inca and Beetle Creek Formations either outcrop, or occur at shallow depths of burial some tens of metres below the surface. This results in these lithologies being weathered which leads to poor recovery when drilled. It was hoped that by drilling through the Devoncourt

Limestone in a deeper inclined hole at the northern end of Rogers Ridge it would be possible to reach fresh unweathered phosphorites and siltstones of the Beetle Creek Formation. Although this strategy would appear straightforward structural complexities caused by faulting and thrusting in this area always presented potential problems.

Preliminary Results

Sequence Duchess 18 penetrated :

1) Devoncourt Limestone 0 - 132.50m

2) Inca Formation 132.50m - 136.39m

3) Monastery Creek Phosphorite Member of the Beetle Creek Formation 136.39 - 184.50m (this interval is faulted towards its base)

4) Siltstone Member of the Beetle Creek Formation 184.50 - 187m

5) Thorntonia Limestone 187 - 233m

6) Mount Birnie Beds 233 - 241.55m

Weathering The uppermost 40m of the Devoncourt Limestone is weathered to form a yellow-brown siltstone. Between 40m and 100m the weathered intervals gradually reduce in both frequency and thickness so that the core consists of interbanded, yellow-brown siltstones and dark grey to black silty limestones. Beneath 100m weathering is restricted to thin bands of yellow-brown siltstone of 1-2cm thickness, and limonite stains along fractures and veins.

Lithologies The Devoncourt Limestone is a monotonous sequence of rhythmically laminated dark to medium grey, silty limestones interbedded with scattered thin beds of peloid, skeletal packstone and wackestone and black chert. Laminae are 0.1-0.8mm thick. They have erosion or scoured contacts with the underlying mudstones and grade from peloid wackestones into homogeneous black mudstones. Peloid, skeletal packstones and wackestones occur between 83-84m and 108-115m.

The Inca Formation is represented by a thin interval of concretionary, dolomitic and phosphatic limestone, chert and finely laminated brown dolostone. Concretions up to 30cms in diameter consist of laminated mudstones and wackestones with peloidal wackestone and packstone laminae and thin beds. Glauconite and phosphate grains are common in this interval and some thin packstone beds are capped by erosion surfaces. These coarser grained units are often associated with concretions, some of which are several centimetres across. Phosphate cemented surfaces and crusts occur in some of the concretions. The crusts are less than 1cm thick and are usually characterized by scoured upper surfaces. Sponge spicules are common.

Between 136.39m and 184.50m the Monastery Creek Phosphorite Member consists of an interbedded sequence of finely laminated dolomitic silty limestone, dark brown, peloid skeletal intraclast packstone and wackestone phosphorite and black chert. The cherts form thin to medium beds of 1-20cm thickness and also occur as a cement or matrix in some of the grain-supported phosphorites. The phosphorites form beds 1-3cm thick that accumulate to form intervals up to 1.2m thick. Sharp erosion surfaces separate the beds of packstone and wackestone phosphorite which are frequently draped by thin mudstone laminae. In some instances the uppermost part of a phosphorite bed is cemented by phosphate to form a thin irregular hardground. Such *in situ* pavements are generally no more than several millimetres thick and are frequently overlain by thin accretionary crusts of mudstone phosphate. Burrows occur at the base of some of the granular beds. The finely laminated dolomitic silty limestones form units up to 10cm in thickness. They occur interbedded with the phosphorites and cherts.

Between 184.5m and 187m a sequence of brecciated and fractured black cherts and siltstones with abundant slickensides is interpreted as the ?faulted remnant of the Siltstone Member of the Beetle Creek Formation. Dips on core taken from beneath this interval vary from 0^{o}-5^{o}, but above the brecciated zone, dips throughout the Phosphorite Member range from 20^{o}-90^{o}, rendering its true thickness impossible to determine. Beneath the brecciated zone occurs a 1m thick interval of black chert, which rests disconformably on mottled dolomitic limestones of the Thorntonia Limestone. As the contact between the Thorntonia Limestone and the overlying cherts is unaffected by brecciation it suggests that a fault occurs 1m above this contact in the interval 186.7m-184m. Thus far it has not been possible to accurately date the 1m thick interval of black chert that overlies the Thorntonia Limestone. However, for the purposes of this Record it is placed in the Beetle Creek Formation. On Rogers Ridge, cherts from this stratigraphic interval contain trilobites, indicative of a Templetonian age.

The Thorntonia Limestone can be subdivided into three groups of lithologies. The uppermost unit, between 187.73m and 199.52m, is a cyclic sequence of mottled, phosphatic dolomitic limestones. Dominated by phosphatic mudstones this cyclic interval contains phosphatic hardgrounds, peloid skeletal packstones and coquinas. Disconformity or diastem surfaces occur on top of the unit. Underlying, and separated from it by an erosion surface, is a sequence of laminoid fenestral dolostones, stromatolitic dolostones, and peloid intraclast grainstones and gravels. Indurated erosion surfaces, desiccation cracks and teepee structures are found in this dolostone unit which occurs between 199.52m and 207.5m. In thin section, grainstones contain meniscus and pendant cements as well as vadose silts. Collectively these sedimentary structures indicate subaerial exposure and emergence during deposition of the unit. The basal unit of the Thorntonia Limestone, occuring between 207.5m and 233m, consists of recrystallised and vuggy dolostone with scattered chert nodules. Sedimentary structures are lacking.

The Mount Birnie Beds occur between 233m and the bottom of the hole at 241.55m. These rocks are dominated by nodular and laminated siltstones and mudstones which are frequently disrupted by desiccation cracks now infilled by fine sand and silt. A gradational and conformable contact separates the Mount Birnie Beds from the Thorntonia Limestone.

Hydrocarbons Fractures and veins in the Devoncourt and Thorntonia Limestone and Beetle Creek Formation are frequently stained, and in some cases filled, by bitumen. Total organic carbon contents in these formations varied from less than 1% to 6%.

Palaeontology The age of stratigraphic units reported here and a summary of their palaeontological characterisation is given in appendix 1.

Urandangi 10

Well Index Number 4130

Date Drilled August 1986

Position 21°40'S 139°17'E

Elevation Approximately 340m.

Rig Mayhew 1000

Drilling Open hole drilling to 20m, followed by continuous coring to 85.90m. Drilling was terminated due to loss of circulation in a cavern estimated to be seventy centimetres deep.

Geologist J.R. Laurie

Objectives To obtain fresh drill core from the Blazan Shale, Beetle Creek Formation, Thorntonia Limestone and Chert Member of the Thorntonia Limestone. Use the core to assist in refining stratigraphic relationships between the Beetle Creek Formation, Thorntonia Limestone and Chert Member of the Thorntonia Limestone and determine the thicknesses of these units. Use the core samples for comparative geochemical work between the Ardmore and Duchess phosphate deposits.

Target Riversdale Formation (a lateral facies equivalent of the Mount Birnie Beds)

Discussion Percussion drilling by Queensland Phosphate Ltd in the Ardmore Outlier had identified an area in the northern parts of the deposit where fresh, organic-rich black shales thought to be from the Blazan Shale occurred approximately 40-50 metres below the surface. It was hoped to be able to penetrate this interval and in so doing obtain unweathered phosphate from the underlying lithologies.

Preliminary Results

Sequence Urandangi 10 penetrated :

1) Inca Formation 0-40m.

2) Breccia of uncertain affinity 40m-84.90m.

Weathering Abundant pyrite and the dark grey to black colour suggest that the core is relatively unweathered.

Lithologies Finely laminated and normally graded siltstones and shales occur between 20m and 40m. Beneath this interval the core is brecciated. The breccia blocks consist of:

1) black finely laminated chert

2) finely laminated siltstone and mudstone

3) recrystallised light to medium grey dolostone

4) brown to grey granular phosphorite.

APPENDICES

APPENDIX 1

A PALAEONTOLOGICAL ANALYSIS OF BMR DUCHESS NO. 18 COREHOLE

Compiled by J.H. Shergold

With contributions from J.R. Laurie and P.J. Jones

A palaeontological appraisal of core from BMR Duchess No. 18

Fauna has been recovered from 27 horizons between 15.95 - 184.45 m in BMR Duchess No. 18. Mostly, it is found in acid-etched phosphatic residues in which it is frequently prolific: non-phosphatic sections of the core have yielded comparatively little palaeontological information.

Seventeen of the samples are from the Monastery Greek Phosphorite Member of the Beetle Creek Formation which occurs over the interval 136.39 - 184.50 m; six are from the non-phosphatic Devoncourt Limestone (0 - 132.50 m); and a further four are from a concretionary carbonate and black shale intercalation assigned to the Inca Formation which occupies a 3.9 m interval (132.50 - 136.39 m) between the Beetle Creek Formation and the Devoncourt Limestone, and is also phosphatic. The silicified Siltstone Member of the Beetle Creek Formation has yielded no fauna in BMR Duchess No. 18. Neither the Thorntonia Limestone nor the Mount Birnie Beds were sampled in the core. Nowhere has the latter yielded age diagnostic body fossils, and the former repeats lithofacies seen at Rogers Ridge whose relationships are understood and palaeontologically characterised at outcrop. The ranges of fossil taxa provisionally determined are shown plotted against sample intervals on Fig. 1.

Three faunal assemblages occur in the sampled core, each related to a specific lithostratigraphic unit. The oldest assemblage is that of the Monastery Creek Phosphorite Member of the Beetle Creek Formation. This is essentially dominated by the occurrence of various phosphatocopine bradoriid ostracodes similar to those described from neighbouring Mount Murray by Fleming (1973) and Jones and McKenzie (1980). Nine bradoriid genera, including one new (see Jones, herein, Appendix 2), embrace 13 species. The bradoriids are supported by inarticulate brachiopods, particularly the juvenile stages of an undetermined acrothelid; and trilobites, generally meraspides of undetermined species of *Pagetia, Peronopsis,* Ptychagnostidae and *Xystridura,* and by the rare occurrence of *Triplagnostus gibbus* and ? *Pentagnostus praecurrens.* Commonly occurring and characteristic are the conodont - like organism referred here to *Protohertzina*? sp. undet., sponge spicules (all referred to "*Pleodioria*" sp. indet.), a sphaeroidal body which may represent a sphinctozoan sponge, the enigmatic sclerite *Chancelloria*, and an as yet undetermined annelid. More rare are the molluscan species referrable to *Protowenella* and *Mellopegma* which are similar to species described from the Thorntonia area of the northeastern Georgina Basin, about 150 km northwest of Mount Isa (Runnegar & Jell, 1976). This early assemblage is also known to occur in the Phosphate Hill Mine excavations (detailed by Rogers & Crase, 1980) and at neighbouring Mount Murray (locality D640 of Jell, 1975 and Jones and McKenzie, 1983). The presence of *Triplagnostus gibbus* indicates a late Templetonian age in BMR Duchess 18.

The second assemblage is biologically related to the first. Four samples in the interval 132.50 - 136.39 m are dominated by bradoriid ostracodes, inarticulate brachiopods, sponge spicules, trilobites and molluscs. The fauna is essentially similar to that below except that ptychagnostids are not represented, the bradoriids are diminished in variety and the molluscan assemblage is more varied. In one of the samples both weathered and unweathered phosphatised material occurs, together with pebbles and abraded debris. Molluscs identified as possible species of *Coreospira* and *Latouchella* cf. *accordionata* Runnegar and Jell are previously known only from samples of pre-Templetonian (Ordian) age elsewhere in the Georgina Basin. All these observations suggest the possibility of reworking in this interval which is referred to the Inca Formation. A latest Templetonian age is inferred but not proven, and the possibility of the deposit being a lag at the base of the considerably younger early Undillan Devoncourt Limestone cannot be dismissed.

The youngest assemblage occurs in the Devoncourt Limestone between 15.95 - 127.12 m. It contains only agnostoid trilobites of the *Ptychagnostus punctuosus* group and simple pentact and hexact sponge spicules similar to those described by Öpik (1961, p. 50, p 1.1, Figs. 1a, 1b, text Fig. 16) as *Pleodioria tomacis* Öpik. All such spicules, including those found in clusters in some samples, are referred here to "*Pleodioria*" sp. indet. The age of the third assemblage, on the basis of agnostoid trilobites, is early Undillan. Rocks of the same age, and younger, have been palaeontologically discriminated to the north of the drill site of BMR Duchess No. 18 (Shergold in de Keyser, 1968, Palaeontological Appendix).

The biostratigraphy of BMR Duchess No. 18 confirms the late Templetonian age of the Monastery Creek Phosphorite Member in the northern part of the Duchess phosphate field. Reports of *Triplagnostus gibbus* in this stratigraphic unit have not be confirmed previously leading to the suggestion of a pre-*T.gibbus* age (Shergold and Brasier, 1986, for example). The presence of a regional stratigraphic break at the base of the Devoncourt Limestone, or possibly even at the base of the concretionary carbonate unit referred to the Inca Formation, seems also to be confirmed. Rocks of Floran age, Zones of *Ptychagnostus atavus* and *Euagnostus opimus*, have not been identified in BMR Duchess No. 18, but could be represented by the section 43.80 - 127.12 from which age diagnostic fauna has yet to be recovered. Evidence of reworking in the 3.9 m interval referred to the Inca Formation, however, might support the notion of hiatus which is also present in the northern part of the Burke River Structural Belt according to Henderson and Southgate (1978, Fig. 3), but of slightly differing magnitude.

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Sampled interval	Palaeontological determinations
15.95	Ptychagnostid undet. (of the *punctuosus* group)
43.74 - 43.80 m	*Ptychagnostus affinis* Brøgger "*Pleodioria*" sp. indet.
85.51 - 85.55 m	no recovery
95.30 - 95.36 m	"*Pleodioria*" sp. indet.
97.41 - 97.47 m	no recovery
109.01 - 109.30 m	"*Pleodioria*" sp. indet.
118.90 - 118.93 m	"*Pleodioria*" sp. indet.
127.10 - 127.12 m	"*Pleodioria*" sp. indet.
134.50 - 135.60 m	Acrotretid brachiopod indet. Obolid brachiopod indet. Hyolithida indet. *Monasterium* sp. undet. *Phaseolella dubia* (Jones & McKenzie) *P. sipa* Fleming *Protowenella* cf. *flemingi* Runnegar & Jell *Latouchella* cf. *accordionata* Runnegar & Jell *Chancelloria* sp. indet. "*Pleodioria*" sp. indet. Sphinctozoan? sponge Problematicum (sponge?) Pelmatozoan ossicles indet. Annelid undet. Pagetiid undet.
134.88 - 134.93 m	Acrothelid brachiopod indet. *Amictocracens* sp. indet. Obolid brachiopod indet. Hyolithida indet. *Phaseolella sipa* (Fleming) *P. sestina* (Fleming) *P. dubia* (Jones & McKenzie) *Indota formosa* Fleming *Monasterium dorium* Fleming *Zepaera rete* Fleming *Protohertzina*? sp. undet. *Latouchella* cf. *accordionata* Runnegar & Jell *Pelagiella* cf. *deltoides* Runnegar & Jell

Sampled interval	Palaeontological determinations
	Protowenella cf. *flemingi* Runnegar & Jell *Chancelloria*? sp. indet. *Coreospira* ? sp. indet. Sphinctozoan? sponge "*Pleodioria*" sp. indet. Pagetiid undet. Peronopsid undet. *Xystridura* sp. undet. Problematicum (sponge?) Annelid indet.
135.46 - 135.49 m	Acrotretid brachiopod indet. Obolid brachiopod indet. *Phaseoloella dubia* (Jones & McKenzie) *P. sestina* (Fleming) *P. sipa* Fleming) *Zepaera rete* Fleming *Protohertzina?* sp. undet.
136.34 - 136.39 m	Acrothelid brachiopod indet. Acrotretid brachiopod indet. Obolid brachiopod indet. *Phaseolella dubia* Jones & McKenzie) *P. sipa* (Fleming) *Monasterium dorium* Fleming *Zepaera rete* Fleming *Protohertzina*? sp. undet. *Chancelloria* sp. Sphinctozoan? sponge "*Pleodioria*" sp. indet. Polymeroid trilobite indet. Annelid undet.
137.09 - 137.15 m	Acrothelid brachiopod indet. *Phaseolella sipa* (Fleming) *Monasterium oepiki* Fleming Sphinctozoan? sponge "*Pleodioria*" sp. indet. Pagetiid undet. Peronopsid indet. *Xystridura* sp. undet. Ptychopariid undet. Annelid undet.

Sampled interval	Palaeontological determinations
138.30 - 138.50 m	Acrothelid brachiopod indet. *Phaseolella dubia* (Jones & McKenzie) *P. sipa* (Fleming) *P. sestina* (Fleming) *Monasterium oepiki* Fleming *Zepaera rete* Fleming *Protohertzina?* sp. indet. *Chancelloria* sp. indet. Sphinctozoan? sponge Annelid undet. "*Pleodioria*" sp. indet. Pelmatozoan ossicles Pagetiid undet. *Xystridura* sp. undet. Ptychopariid undet.
138.59 - 138.61 m	Acrothelid brachiopod indet. *Flemingopsis duo* (Jones & McKenzie) *Monasterium oepiki* Fleming *Phaseolella sipa* (Fleming) Sphinctozoan? sponge "*Pleodioria*" sp. indet. Pagetiid undet. *Xystridura* sp. undet Problematicum cf. *Utahphospha?* sp.
139.24 - 139.39 m	Acrothelid brachiopod indet. Obolid brachiopod indet. *Flemingopsis duo* (Jones & McKenzie) *Monasterium* sp. indet. *Phaseolella sipa* (Fleming) *Zepaera rete* Fleming Annelid undet. "*Pleodioria*" sp. indet. Pagetiid undet. Ptychopariid undet.
140.44 - 140.49 m	Acrothelid brachiopod indet. Acrotretid brachiopod indet. Obolid brachiopod indet. *Flemingopsis duo* (Jones & McKenzie) *Monasterium dorium* (Fleming) *Phaseolella sipa* (Fleming) *Zepaera rete* Fleming *Chancelloria* sp. indet. "*Pleodioria*" sp. indet.

Sampled interval	Palaeontological determinations
	Monoplacophoran indet. Pagetiid undet. Ptychopariid undet. *Xystridura* sp. undet. Annelid undet.
141.42 - 141.51 m	Acrothelid brachiopod indet. Obolid brachiopod indet. *Monasterium oepiki* Fleming *Phaseolella sipa* (Fleming) *Zepaera rete* Fleming *Protohertzina?* sp. undet. *Chancelloria* sp. indet. "*Pleodioria*" sp. indet. Sphinctozoan? sponge Annelid indet. *Pelagiella*? sp. Pagetiid undet. Peronopsid undet. Ptychopariid undet.
142.27 - 142.35 m	Obolid brachiopod indet. *Phaseolella sipa* (Fleming) *Zepaera rete* Fleming "*Pleodioria*" sp. indet. Peronopsid undet. Ptychopariid undet.
143.02 - 143.16 m	Acrothelid brachiopod indet. Obolid brachipod indet. *Monasterium dorium* Fleming *Phaseolella sipa* (Fleming) *Zepaera rete* (Fleming) *Protohertzina?* sp. indet. "*Pleodioria*" sp. indet. Pagetiid undet. Peronopsid undet. Ptychopariid undet. *Xystridura* sp. undet.
150.36 - 150.48 m	Acrothelid brachiopod indet. *Linnarssonia* sp. indet. Obolid brachiopod indet. *Flemingopsis duo* (Jones & McKenzie)

Sampled interval	Palaeontological determinations
	Phaseolella sipa (Fleming) *Zepaera rete* Fleming Pelmatozoan ossicles "*Pleodioria*" sp. indet. Annelid undet. *Mellopegma* cf. *georginensis* Runnegar & Jell Peronopsid undet. *Xystridura* sp. undet.
153.16 - 153.29 m	Acrothelid brachipod indet. *Phaseolella sipa* (Fleming) Pelmatozoan ossicles "*Pleodioria*" sp. indet. Problematicum aff. *Microdictyon* sp. Pagetiid undet. Peronopsid undet. *Xystridura* sp. undet. Annelid indet.
156.55 - 156.69 m	Acrothelid brachiopod indet. Obolid brachiopod indet. Hyolithid indet. *Monasterium oepiki* Fleming *Phaseolella dubia* (Jones & McKenzie) *P. sestina* (Fleming) *P. sipa* (Fleming) *Svealuta* sp. *A* Jones & McKenzie *Zepaera rete* Fleming *Protohertzina?* sp. indet. Sphinctozoan ? sponge "*Pleodioria*" sp. indet. Annelid indet. Pagetiid undet. Peronopsid undet. Ptychopariid undet. *Triplagnostus gibbus* (Linnarsson) *Xystridura* sp. undet.
170.07 - 170.31 m	Acrothelid brachiopod indet. Acrotretid brachiopod indet. *Paseolella sestina* (Fleming) *P. sipa* (Fleming) *Zepaera rete* Fleming *Protohertzina?* sp. undet. Sphinctozoan ? sponge Polymeroid trilobites indet.

Sampled interval	Palaeontological determinations
177.85 - 177.92 m	Insufficient residue to pick
179.35 - 179.43 m	Acrothelid brachiopod indet. Obolid brachiopod indet. *Zepaera rete* Fleming Sphinctozoan ? sponge *Mellopegma* cf. *georginensis* Runnegar & Jell *Protowenella* cf. *flemingi* Runnegar & Jell
180.67 - 180.83 m	Acrotretid brachiopod indet. Obolid brachiopod indet. Hyolithid indet. *Monasterium* sp. undet. Sphinctozoan ? sponge *Protowenella* cf. *flemingi* Runnegar & Jell *Mellopegma* cf. *georginensis* Runnegar & Jell Pagetiid undet. (?) *Pentagnostus praecurrens* (Westergaard) Ptychagnostid indet. (granulose) Polymeroid trilobite indet. *Xystridura* sp. undet.
181.86 - 181.95 m	Acrotretid brachiopod indet. *Phaseolella sipa* (Fleming) "*Pleodioria*" sp. indet. Agnostoid trilobite indet.
184.31 - 184.45 m	Acrothelid brachiopod indet. Acrotretid brachiopod indet. Obolid brachiopod indet. *Flemingopsis duo* (Jones & McKenzie) *Hesslandona* sp. *Monasterium oepiki* Fleming *Ovaluta* ? sp. *Phaseolella dubia* (Jones & McKenzie) *P. sestina* (Fleming) *P. sipa* (Fleming) *Zepaera rete* (Fleming) *Protohertzina?* sp. undet. Pelmatozoan ossicles Sphinctozoan ? sponge "*Pleodioria*" sp. indet. *Protowenella* cf. *flemingi* Runnegar & Jell *Mellopegma* cf. *georginensis* Runnegar & Jell Annelid undet. Ptychagnostid undet. (granulose) Polymeroid trilobite indet.

APPENDIX 2.

EARLY MIDDLE CAMBRIAN BRADORIIDA FROM BMR DUCHESS NO. 18 COREHOLE

By

P.J. Jones

Introduction

Bradoriids (mainly Phosphatocopida) recovered from two core samples taken from the Beetle Creek Formation penetrated by BMR Duchess No. 18 corehole were submitted by J.H. Shergold for identification and age determination. Both samples (156.55-156.69 m : 184.31-184.45 m) contained abundant well-preserved specimens, the lower one being only slightly more diverse in numbers of species.

Results

156.55 - 156.69 m	No. Specimens
Monasterium oepiki Fleming, 1973	(3)
Phaseolella dubia (Jones & McKenzie, 1980)	(14)
P. sestina (Fleming, 1973)	(5)
P. sipa (Fleming, 1973)	(6)
Svealuta sp. A Jones & McKenzie, 1980	(3)
Zepaera rete Fleming, 1973	(3)
N. gen. (pustulose) form A Jones & McKenzie, 1980	(2)
184.31-184.45 m	
Flemingopsis duo (Jones & McKenzie, 1980)	(11)
Hesslandona sp. nov.	(6)
Monasterium oepiki Fleming,	(2)
Ovaluta ? sp.	(3)
Phaseolella dubia (Jones & McKenzie, 1980)	(5)
P. sestina (Fleming, 1973)	(5)
P. sipa (Fleming, 1973)	(4)
Zepaera rete (Fleming, 1973)	(9)

Age significance and remarks

This fauna is almost identical to that previously described from the late Templetonian

Triplagnostus gibbus Zone in the Monastery Creek Phosphate Member of the Beetle Creek Formation (Fleming, 1973: Jones & McKenzie, 1980). Three species described from this unit have doubtful generic assignations (*Indiana sipa* Fleming, 1973: *Mononotella sestina* Fleming, 1973; *Dielymella? dubia* Jones & McKenzie, 1980), and can now be referred to the univalved genus *Phaseolella* Zhang, 1987 (type species *Phaseolella dimorpha* Zhang, 1987: lower Cambrian Canglangpu Stage, Xichuan, China). The equivocal evidence on which Zhang, 1987 claims that the type species of *Phaseolella* is dimorphic is not convincing, and is not followed here. There are probably three species of this genus represented among the Xichuan specimens, as there are in the present material. Although species of *Phaseolella* all have a dorsal mid-line, single valves are never found. This suggests that the living condition of the taxon is univalved, and that the dorsal mid-line is developed by post-mortem compression. It is probable that the univalved *Phaseolella* is the precursor of the twin-hinged *Hesslandona,* a genus that is represented by a new species in the present fauna. The early Middle Cambrian (Templetonian) age of this fauna is the earliest known record of the genus *Hesslandona.*

The bradoriid (non-phosphatocopid) taxa *Svealuta* sp. A and *Ovaluta?* sp. are phosphatized, and probably shared the same benthic swimming habitat as the Phosphatocopida.

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APPENDIX 3

LITHOLOGIC LOGS

By P.N. Southgate

Legend - Lithologies

- Dolostone
- Sandy Limestone
- Silty Limestone
- Dolomitic Limestone
- Shale, Mudstone
- Siltstone
- Sandstone
- Interbedded Sandstone and Siltstone
- Interbedded Mudstone and Siltstone
- Breccia
- Breccia with a Siltstone Matrix
- Open Hole Drilling

Legend - Symbol Summary

Bedding

- very thick (>100cm)
- thick (30-100cm)
- medium (10-30cm)
- thin (1-10cm)
- laminated (<1cm)
- stylolite
- concretion

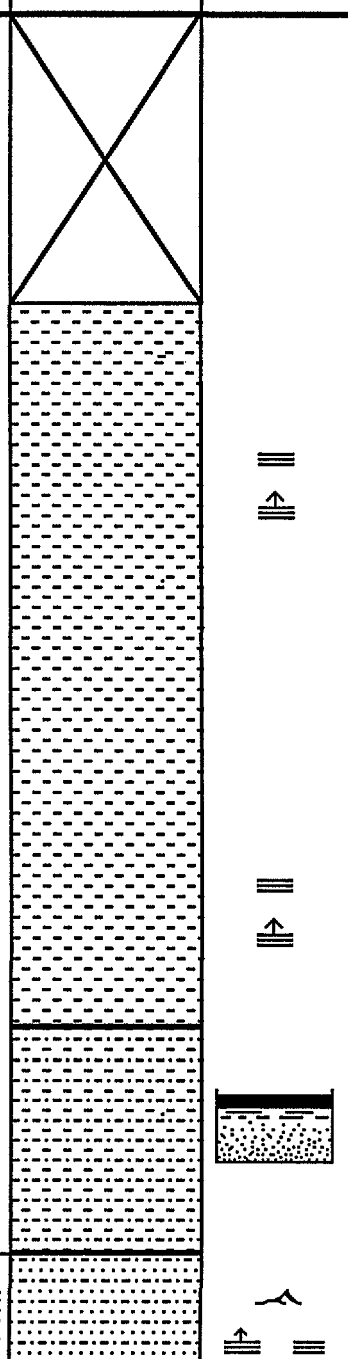
Sedimentary Structures

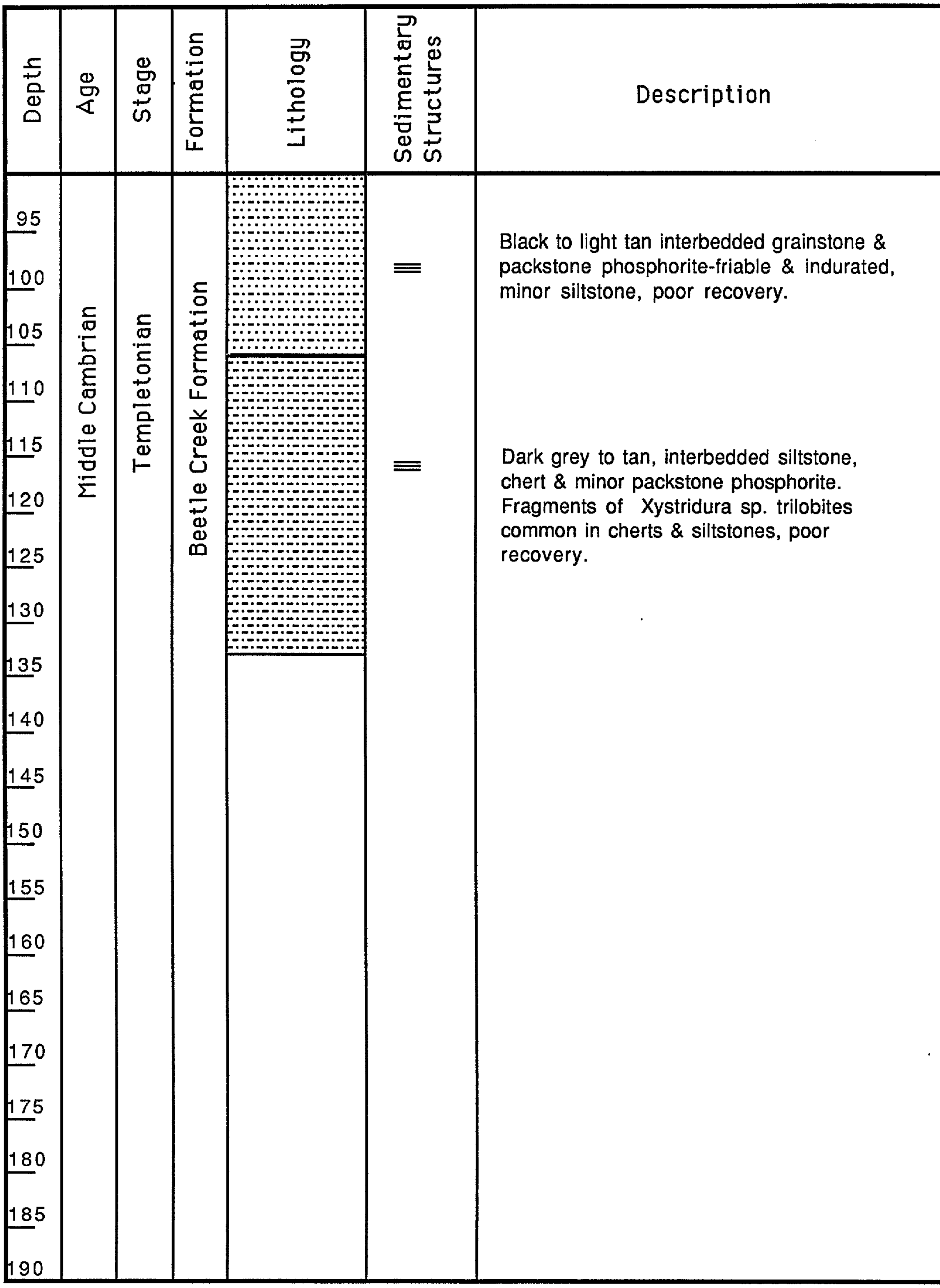
- normally graded laminae
- normally graded
- desiccation crack
- cross bed/lamination
- stromatolite
- fenestrae

diastem or disconformity

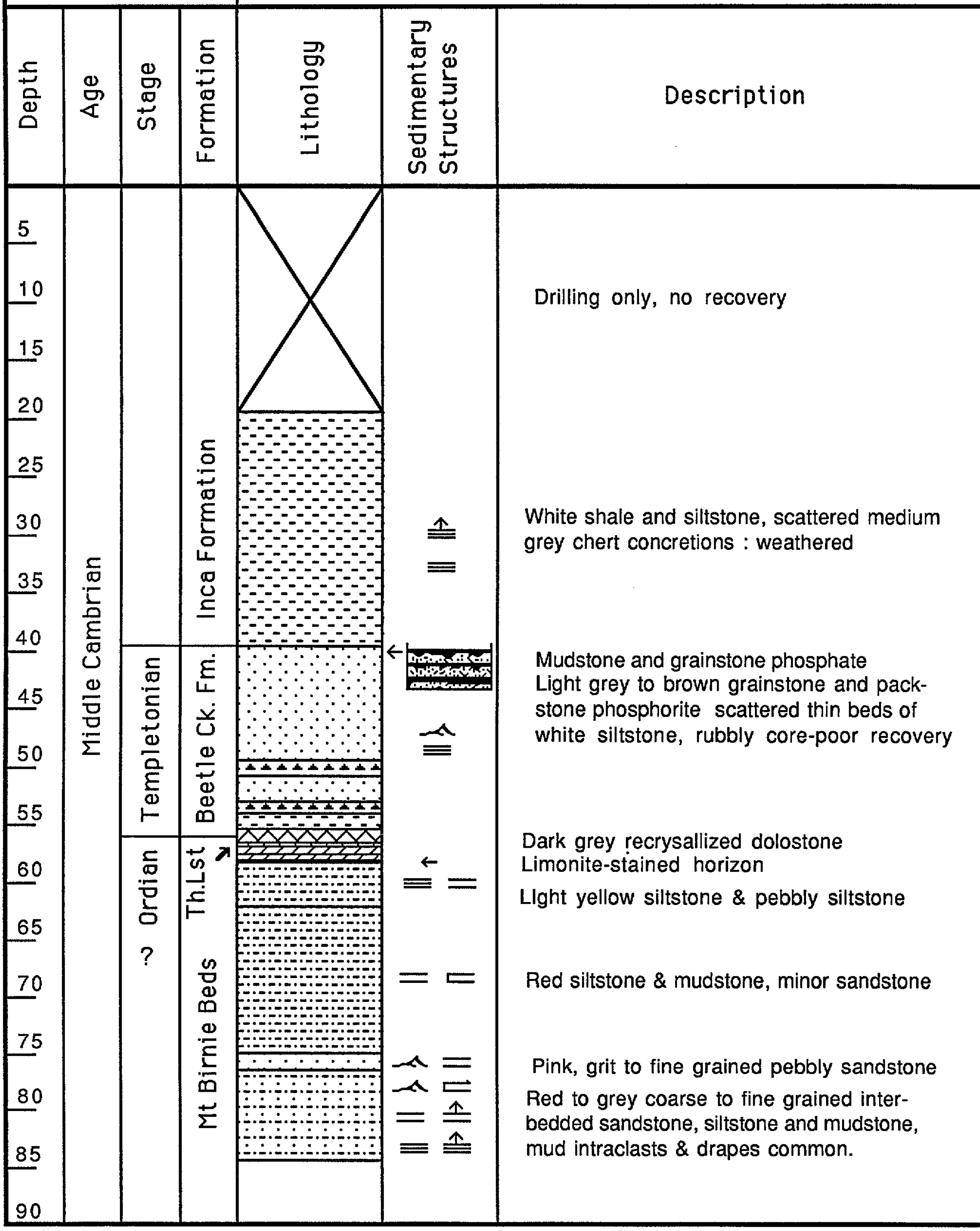
Basin	Georgina	Drill Hole	BMR Duchess 16
Locality	Burke River Structural Belt		

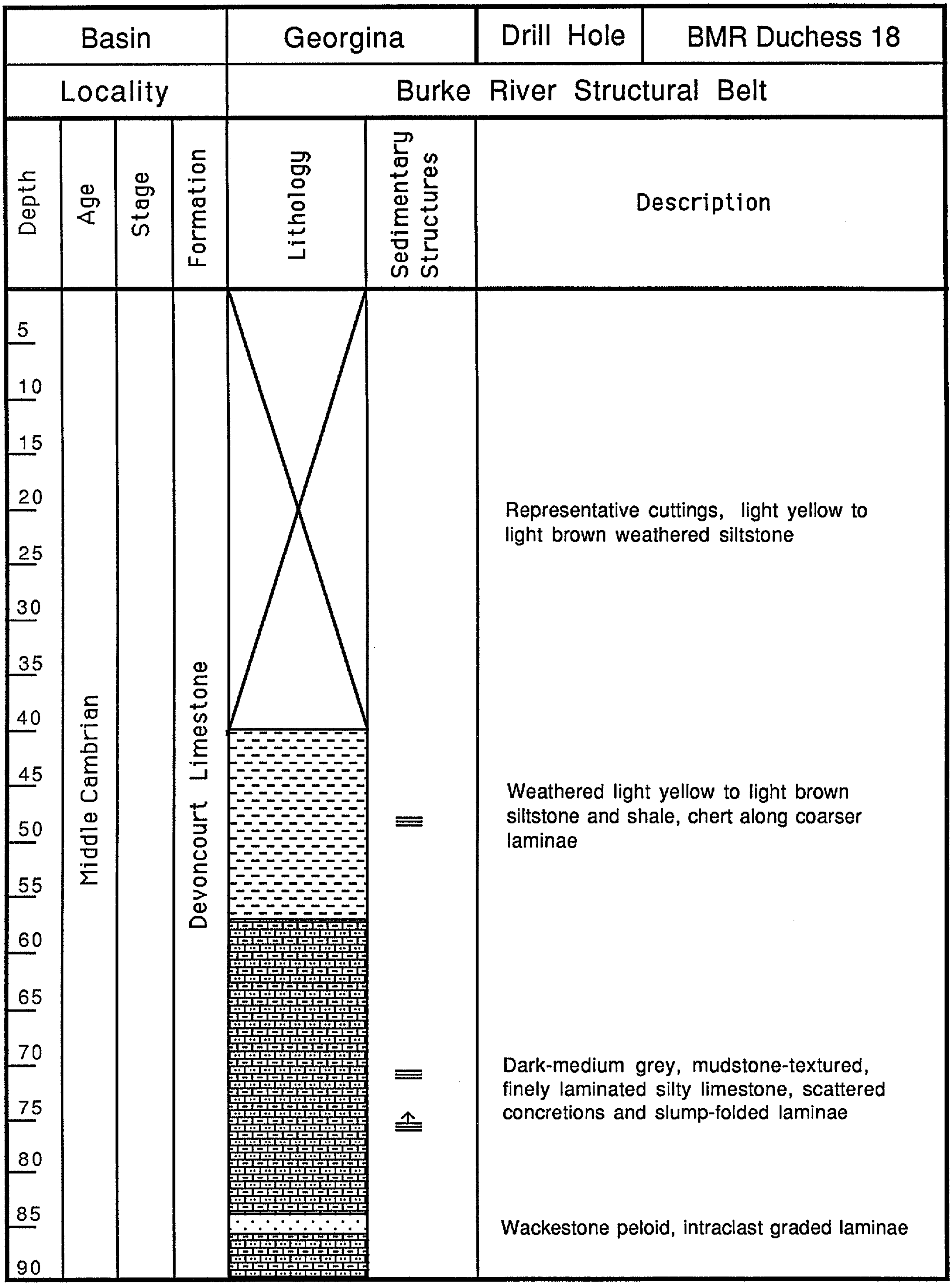
Depth	Age	Stage	Formation	Lithology / Sedimentary Structures	Description
5–20	Middle Cambrian	Floran	Inca Formation		Drilling only, no recovery
20–67	Middle Cambrian	Floran	Inca Formation		White shale : weathered
67–82	Middle Cambrian	Floran	Inca Formation		Dark-medium grey normally graded and finely laminated siltstone and shale, calcareous toward base.
82–90	Middle Cambrian	Tmpl-tnian	B. Ck. Fm.		Light yellow interbedded grainstone & packstone phosphorite, siltstone & chert : poor recovery, friable & rubbly core.

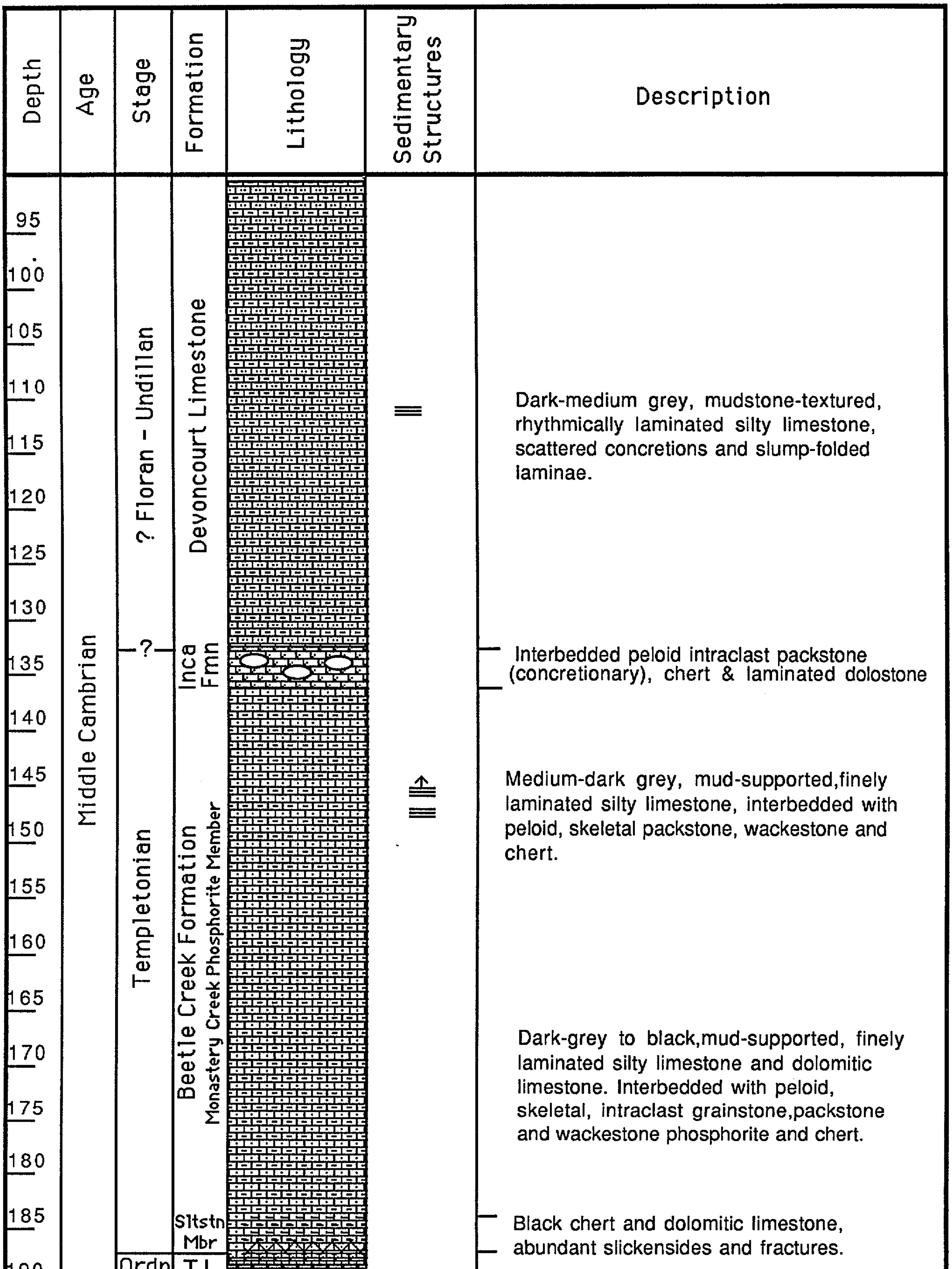


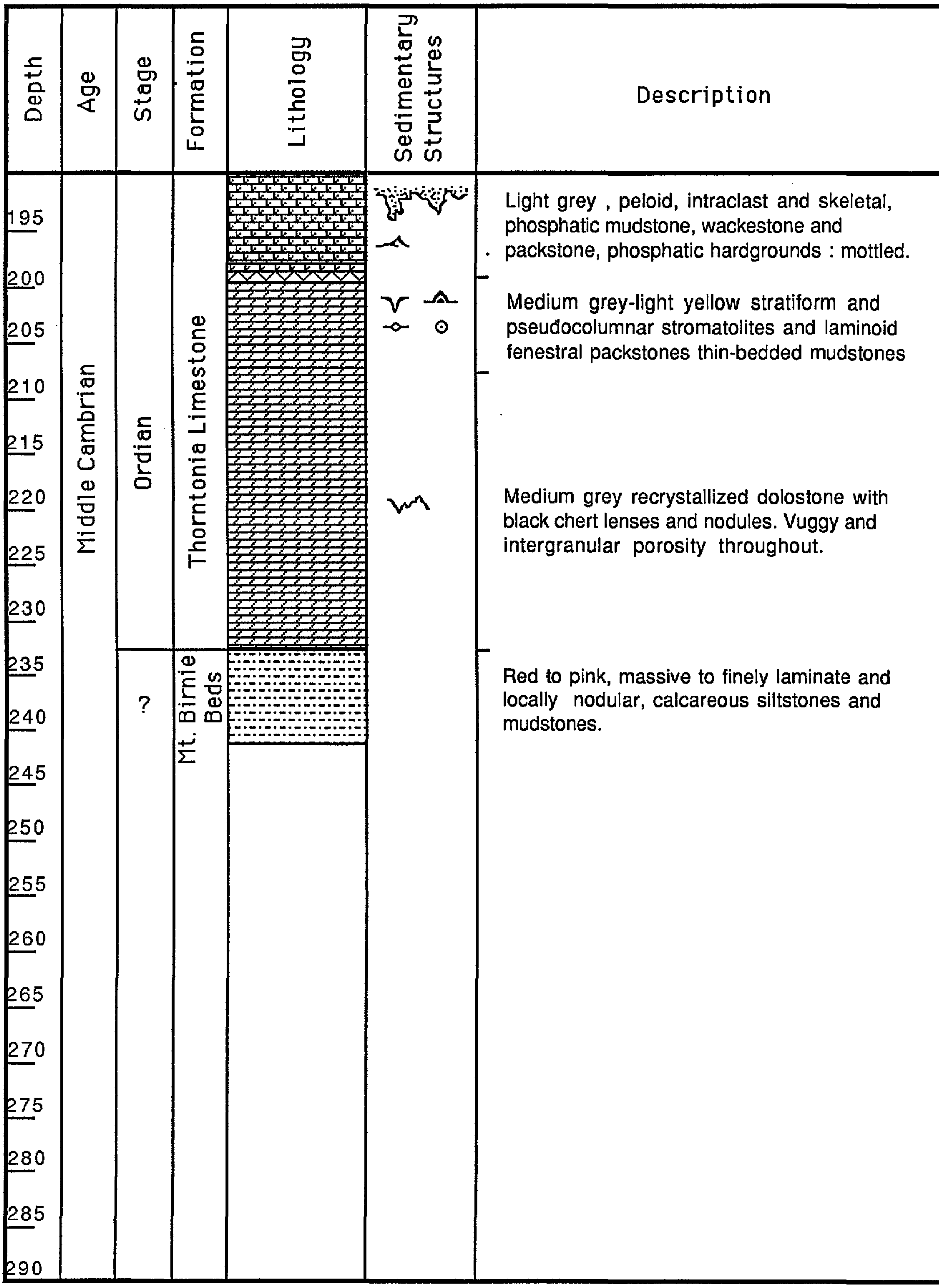

Depth
Age
Stage
Formation
Lithology
Sedimentary Structures
Description
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180
185
190
Middle Cambrian
Templetonian
Beetle Creek Formation
Black to light tan interbedded grainstone & packstone phosphorite-friable & indurated, minor siltstone, poor recovery.
Dark grey to tan, interbedded siltstone, chert & minor packstone phosphorite. Fragments of Xystridura sp. trilobites common in cherts & siltstones, poor recovery.

Basin	Georgina	Drill Hole	BMR Duchess 17
Locality	Burke River Structural Belt		




Basin
Georgina
Drill Hole
BMR Duchess 18
Locality
Burke River Structural Belt
Depth
Age
Stage
Formation
Lithology
Sedimentary Structures
Description
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
Middle Cambrian
Devoncourt Limestone
Representative cuttings, light yellow to light brown weathered siltstone
Weathered light yellow to light brown siltstone and shale, chert along coarser laminae
Dark-medium grey, mudstone-textured, finely laminated silty limestone, scattered concretions and slump-folded laminae
Wackestone peloid, intraclast graded laminae

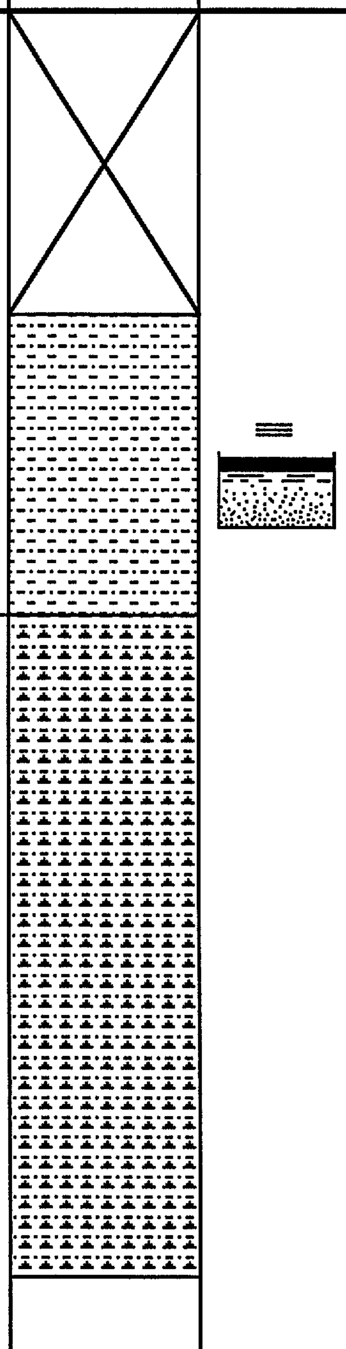

Depth
Age
Stage
Formation
Lithology
Sedimentary Structures
Description
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180
185
190
Middle Cambrian
? Floran - Undillan
?
Templetonian
Ordn
Devoncourt Limestone
Inca Fmn
Beetle Creek Formation
Monastery Creek Phosphorite Member
Sltstn Mbr
T.L.
Dark-medium grey, mudstone-textured, rhythmically laminated silty limestone, scattered concretions and slump-folded laminae.
Interbedded peloid intraclast packstone (concretionary), chert & laminated dolostone
Medium-dark grey, mud-supported,finely laminated silty limestone, interbedded with peloid, skeletal packstone, wackestone and chert.
Dark-grey to black,mud-supported, finely laminated silty limestone and dolomitic limestone. Interbedded with peloid, skeletal, intraclast grainstone,packstone and wackestone phosphorite and chert.
Black chert and dolomitic limestone, abundant slickensides and fractures.


Depth
Age
Stage
Formation
Lithology
Sedimentary Structures
Description
195
200
205
210
215
220
225
230
235
240
245
250
255
260
265
270
275
280
285
290
Middle Cambrian
Ordian
?
Thorntonia Limestone
Mt. Birnie Beds
Light grey , peloid, intraclast and skeletal, phosphatic mudstone, wackestone and packstone, phosphatic hardgrounds : mottled.
Medium grey-light yellow stratiform and pseudocolumnar stromatolites and laminoid fenestral packstones thin-bedded mudstones
Medium grey recrystallized dolostone with black chert lenses and nodules. Vuggy and intergranular porosity throughout.
Red to pink, massive to finely laminate and locally nodular, calcareous siltstones and mudstones.

Basin	Georgina	Drill Hole	BMR Urandangi 10
Locality	Ardmore Outlier		

Depth	Age	Stage	Formation	Lithology	Sedimentary Structures	Description
5–20	Middle Cambrian	Templetonian	Blazan Shale (Inca Formation)			No recovery
20–40	Middle Cambrian	Templetonian	Blazan Shale (Inca Formation)			Light to medium grey finely laminated siltstone & shale.
40–90	Middle Cambrian	Templetonian	? Blazan Shale & Beetle Creek Formation			Light to dark grey & black breccia composed of blocks of : 1) finely laminated chert 2) laminated siltstone 3) recrystallized dolostone 4) packstone phosphorite 5) mudstone in a matrix of mudstone and siltstone with abundant pyrite.

Depth scale: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90



APPENDIX 4.

DRILLING RECORDS

DUCHESS NO. 16

Core No.	Interval	Recovery	Loss	Core No.	Interval	Recovery	Loss
1.	88.50 - 90.00	.45	1.05	29.	102.80 - 103.20	.15	.25
2.	90.00 - 90.60	.40	.20	30.	103.20 - 103.60	.40	Nil.
3.	90.60 - 90.70	.10	Nil.	31.	103.60 - 103.80	.20	Nil.
4.	90.70 - 90.90	.12	.08	32.	103.80 - 104.55	.40	35
5.	90.90 - 91.20	.20	.10	33.	104.55 - 104.80	.20	.5
6.	91.20 - 91.60	.20	.20	34.	104.80 - 105.05	.25	Nil.
7.	91.60 - 91.90	.10	.20	35.	105.05 - 105.35	.25	.5
8.	91.90 - 92.15	.05	.20	36.	105.35 - 105.75	.40	Nil.
9.	92.15 - 92.50	.20	.15	37.	105.75 - 106.60	.65	20
10.	92.50 - 93.10	.25	.35	38.	106.60 - 107.25	.60	.5
11.	93.10 - 93.50	.15	.25	39.	107.25 - 107.65	.30	.10
12.	93.50 - 94.25	.40	.35	40.	107.65 - 108.55	.30	.60
13.	94.25 - 95.00	.40	.35	41.	108.55 - 109.60	.12	.93
14.	95.00 - 95.25	.20	.05	42.	109.60 - 110.60	.25	.75
15.	95.25 - 96.10	.25	.60	43.	110.60 - 111.10	.42	.8
16.	96.10 - 96.70	.10	.50	44.	111.10 - 111.70	.25	.35
17.	96.70 - 97.20	.40	.10	45.	111.70 - 112.60	.33	.57
18.	97.20 - 97.45	.10	.15	46.	112.60 - 113.35	.15	.60
19.	97.45 - 98.00	.40	.15	47.	113.35 - 113.90	.15	.40
20.	98.00 - 98.75	.40	.35	48.	113.90 - 114.20	.5	.25
21.	98.75 - 100.05	.20	1.10	49.	114.20 - 114.70	.20	.30
22.	100.05 - 100.60	.10	.45	50.	114.70 - 115.10	.25	.15
23.	100.60 - 100.95	.20	.15	51.	115.10 - 115.30	.6	.14
24.	100.95 - 101.35	.30	.10	52.	115.30 - 116.30	.30	.70
25.	101.35 - 101.80	.35	.10	53.	116.30 116.90	.26	.34
26.	101.80 - 102.10	.10	.20	54.	116.90 - 117.40	.25	.25
27.	102.10 - 102.35	.17	.8	55.	117.40 - 118.05	.25	.40
28.	102.35 - 102.80	.18	.27	56.	118.05 - 118.30	.16	.9
	14.30m	6.47	7.83		15.50m	7.55	7.95

88.50-118.30 = 29.08 recovery = 14.02m = 47.047%

DUCHESS NO. 16

Core No.	Interval	Recovery	Loss	
57.	118.30 - 118.70	.30	.10	
58.	118.70 - 119.45	.50	.25	
59.	119.45 - 119.90	.20	.25	
60.	119.90 - 121.40	.33	1.17	
61.	121.40 - 121.60	.3	.17	
62.	121.60 - 121.80	.16	.4	
63.	121.80 - 122.45	.35	.30	
64.	121.45 - 123.90	.15	*1.30	(*Est 40-50cm cavity)
65.	123.90 - 124.20	.15	.15	
66.	124.20 - 124.60	.15	.25	
67.	124.60 - 124.95	.16	.19	
68.	124.95 - 125.30	.17	.18	
69.	125.30 - 125.65	.14	.21	
70.	125.65 - 127.60	.25	.65	
71.	126.70 - 127.60	.25	.65	
72.	127.60 - 128.40	.10	.70	
73.	128.40 - 129.10	.15	.55	
74.	129.10 - 129.45	.15	.20	
75.	129.45 - 130.60	.20	.95	
76.	130.60 - 133.30	.10	2.60	
	15.00	4.07	10.93	

Interval
88.50 - 133.30
= 44.80m
Recovery = 18.09m
= 40.38%

133.30m T.D.

Interval 118.30 - 133.30
= 15.00
Recovery 4.07 = 37.23%
Loss 10.93 = 62.77%

BMR DUCHESS NO. 18

Core Intervals

HQ Core

39.20 - 40.70	69.20 - 70.65	97.10 - 100.10	139.90 - 142.55	163.60 - 164.60
40.70 - 42.20	70.65 - 72.70	100.10 - 103.10	142.55 - 142.70	164.60 - 164.80
42.20 - 43.70	72.60 - 73.60	103.10 - 106.10	142.70 - 143.60	164.80 - 165.20
43.70 - 44.15	73.60 - 74.20	106.10 - 109.10	143.60 - 143.90	165.20 - 165.90
44.15 - 45.20	74.20 - 75.05	109.10 - 110.20	143.90 - 144.10	165.90 - 166.60
45.20 - 45.50	75.05 - 75.20	110.20 - 110.30	144.10 - 144.50	166.60 - 166.80
45.50 - 45.65	75.20 - 75.30	110.30 - 111.00	144.50 - 144.70	166.80 - 167.00
45.65 - 47.15	75.30 - 76.40	111.00 - 112.30	144.70 - 145.30	167.00 - 167.90
47.15 - 48.20	76.40 - 76.65	112.30 - 112.40	145.30 - 147.10	167.90 - 168.20
48.20 - 48.45	76.65 - 78.15	112.40 - 113.70	147.10 - 148.40	168.20 - 169.60
48.45 - 48.65	78.15 - 78.70	113.70 - 114.05	148.40 - 149.80	169.60 - 171.65
48.65 - 50.15	78.70 - 78.75	114.05 - 115.90	149.80 - 151.80	171.65 - 173.20
50.15 - 50.60	78.75 - 80.25	115.90 - 116.40	151.80 - 152.05	173.20 - 174.85
50.60 - 51.30	80.25 - 80.40	116.40 - 118.60	152.05 - 152.70	174.85 - 175.90
51.30 - 52.80	Reduced HQ	118.60 - 119.10	152.70 - 153.30	175.90 - 178.50
52.80 - 54.20	to NQ Core	119.10 - 121.00	153.30 - 153.90	178.50 - 178.90
54.20 - 55.70	80.40 - 82.60	121.00 - 124.00	153.90 - 154.20	178.90 - 180.70
55.70 - 57.20	82.60 - 83.15	124.00 - 126.60	154.20 - 155.10	180.70 - 181.30
57.20 - 58.70	83.15 - 85.60	126.60 - 128.50	155.10 - 156.00	181.30 - 182.55
58.70 - 60.20	85.60 - 88.20	128.50 - 128.90	156.00 - 156.20	182.55 - 182.90
60.20 - 61.70	88.20 - 89.10	128.90 - 129.30	156.20 - 157.40	182.90 - 183.60
61.70 - 63.20	89.10 - 89.50	129.30 - 130.00	157.40 - 158.80	183.60 - 185.90
63.20 - 64.70	89.50 - 89.90	130.00 - 133.00	158.80 - 159.00	185.90 - 186.20
64.70 - 66.20	89.90 - 91.10	133.00 - 136.00	159.00 - 160.60	186.20 - 186.70
66.20 - 67.70	91.10 - 94.10	136.00 - 138.40	160.60 - 161.40	186.70 - 187.20
67.70 - 69.20	94.10 - 97.10	138.40 - 139.90	161.40 - 163.60	187.20 - 187.60

HQ Core Intervals, Cont :

187.60 - 188.80
188.80 - 190.70
190.70 - 193.60
193.60 - 196.60
196.60 - 196.90
196.90 - 197.20
197.20 - 199.60
199.60 - 201.10
201.10 - 202.40
202.40 - 204.10
204.10 - 206.90
206.90 - 207.50
207.50 - 209.10
209.10 - 209.70
209.70 - 210.40
210.40 - 210.60
210.60 - 211.10
211.10 -211.80
211.80 - 212.90
212.90 - 213.75
213.75 - 214.90
214.90 - 215.25
215.25 - 217.60
217.60 - 218.30
218.30 - 220.50
220.50 - 220.70
220.70 - 221.20
221.20 - 223.50
223.50 - 224.15
224.15 - 226.60
226.60 - 227.00
227.00 - 228.10
228.10 - 228.50
228.50 - 229.05
229.05 - 229.50
229.50 - 230.60
230.60 - 230.90
230.90 - 231.90
231.90 - 232.35
232.35 - 232.50
232.50 - 233.10
233.10 - 233.70
233.70 - 236.70
236.70 - 239.55
239.55 - 241.55

241.55 T.D.

LOSS CORE INTERVALS

48.40 - 48.65	= Loss	.25
49.95 - 50.49		.54
51.24 - 51.30		.06
65.10 - 65.45		.35
76.30 - 76.45		.15
89.65 - 90.15		.50
112.30 - 112.40		.10
118.60 - 118.70		.10
128.75 - 128.90		.15
142.55 - 142.64		.09
144.02 - 144.10		.08
145.02 - 145.30		.28
208.10 - 208.50		.40
209.50 - 209.70		.20
210.10 - 210.40		.30
217.92 - 218.05		.13
232.70 - 233.40		.70
239.53 - 239.65		.12
	Total	4.50 m. loss

Total Metres cored
40.00-241.55 = 201.55 m
Core recovery 97.76%

BMR DUCHESS NO. 18

Box No.	Contents	Box No.	Contents	Box No.	Contents
1.	Cuttings to - 5.90 - representative HQ core samples	26.	103.97 - 107.00	55.	192.83 - 195.74
		27.	107.00 - 110.15	56.	195.74 - 198.80
		28.	110.15 - 113.40	57.	198.80 - 202.09
		29.	113.40 - 116.40	58.	202.09 - 205.03
	5.90 - 18.25	30.	116.40 - 119.43	59.	205.03 - 208.10
2.	19.89 - 37.05	31.	119.43 - 122.51	60.	208.10 - 212.40
3.	38.00 - 41.88	32.	122.51 - 125.50	61.	212.40 - 215.56
4.	41.88 - 44.37	33.	125.50 - 128.40	62.	215.56 - 218.52
5.	44.37 - 46.77	34.	128.40 - 131.59	63.	218.52 - 221.47
6.	46.77 - 50.60	35.	131.59 - 134.62	64.	221.47 - 224.48
7.	50.60 - 53.34	36.	134.62 - 137.65	65.	224.48 - 227.67
8.	53.34 - 55.85	37.	137.65 - 140.72	66.	227.67 - 230.90
9.	55.85 - 58.21	38.	140.72 - 143.90	67.	230.90 - 234.32
10.	58.21 - 60.73	39.	143.90 - 147.40	68.	234.32 - 237.31
11.	60.73 - 63.20	40.	147.40 - 150.45	69.	237.31 - 240.48
12.	63.20 - 66.10	41.	150.45 - 153.29	70.	240.48 - 241.55
13.	66.10 - 68.59	42.	153.29 - 156.82		
14.	68.59 - 71.09	43.	156.82 - 159.79		
15.	71.09 - 73.50	44.	159.79 - 162.59		
16.	73.50 - 76.00	45.	162.59 - 165.80		
17.	76.00 - 78.66	46.	165.80 - 168.89		
18.	78.66 - 81.01	47.	168.89 - 171.95		
19.	81.01 - 84.15	48.	171.95 - 174.95		
20.	84.15 - 87.28	49.	174.95 - 177.67		
21.	87.28 - 90.77	50.	177.67 - 180.67		
22.	90.77 - 94.92	51.	180.67 - 183.62		
23.	94.92 - 97.95	52.	183.62 - 186.70		
24.	97.95 - 101.02	53.	186.70 - 189.88		
25.	101.02 - 103.97	54.	189.88 - 192.83		

Coring rate was continuously sampled from 40.00 to T.D. 241.55m