COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

1957/11

OSTRACODA FROM BORE CORES FROM BORE B.M.R. No. 2, LAUREL DOWNS, FITZROY BASIN, WESTERN AUSTRALIA.

by

P. J. Jones

OSTRACODA FROM BORE CORES FROM BORE B.M.R. No. 2, LAUREL DOWNS, FITZROY BASIN, WESTERN AUSTRALIA.

by P. J. Jones

RECORDS NO. 1957/11

- CONTENTS -

1. INTRODUCTION.

Bore B.M.R. No. 2 is situated about 17 miles west-north-west of Fitzroy Crossing, and 0.4 miles south of Laurel Downs Homestead, at 125° 19± E longitude, 18° 07' S latitude. The bore was spudded in on the 8th December 1955, and completed to the total depth of 4,000 feet on the 10th May, 1956. Core samples were taken at intervals of about 100 feet, and cuttings at intervals of 5 feet.

An important feature of the bore cores is the presence of a rich assemblage of ostracods. This is the first occasion in Australia when the ages of bore cores have been based solely on the examination of an ostracod fauna.

2. DETAILED EXAMINATION OF CORES AND CUTTINGS.

Core 1: Depth 50-60 feet; recovery 0 feet 2 inches.

Friable, medium grained, buff coloured quartz sandstone. No fossils found.

Core 2: Depth 150-162 feet: recovery 4 feet 3 inches.

Fine grained, ochre coloured, quartz sandstone, which grades downwards into a coarse siltstone. Ostracods common; badly preserved as internal casts in the middle part of the core, but better preserved specimens were found in the more silty material.

Ostracoda ‡ *Cryptophyllus* n. sp.

Cavellina cf. *ovatiformis* (Ulrich) 1891

Core 3: Depth 250-260 feet; recovery 8 feet 9 inches.

Grey shaly fossiliferous siltstone interbedded with a fine-grained calcareous sandstone. A rich fauna includes brachiopod remains, (fragments of shell material, and "Productus" spines), an internal cast of a taxodont pelecypod, crinoid stems, echinoid remains, (cidaroid spines and tubercles), abundant ostracods, and fish remains (small rhomboid plates).

Ostracoda: Cavellina ovatiformis (Ulrich)
Cavellina cf. geisi (Croneis & Gale) 1938
Cavellina n. sp. 1
Cavellina sp. indet.
Cryptophyllus n. sp.
Lochriella n. sp. 1 aff. fenriri (Coryell & Johnson) 1939
Lochriella n. sp. 2

Core 4: Depth 350-360 feet; recovery 4 feet 0 inches.

Soft grey siltstone alternating with hard bands of silty shelly limestone. Numerous fossils were present; a marine fauna of small brachiopods and "Productus" spines, the annelid Spirorbis, small fragments of crinoid stems, ostracods common, and fish remains (teeth, bones and rhombic scales).

Ostracoda: Cavellina coryelli Croneis & Gale 1938
Cavellina croneisi Coryell & Rozanski 1942
Cavellina parallela Croneis & Gutke 1939
Cryptophyllus n. sp.
Lochriella n. sp. 1 aff. fenriri (Coryell & Johnson) 1939
Microcheilinella sp.
Paraparchites cf. distortus Coryell & Johnson 1939
Paraparchites inornatus (McCoy) 1844
Paraparchites nicklesi (Ulrich) 1891
Paraparchites ovatus Cooper 1941
Paraparchites symmetricus Kummerow 1953
Paraparchites sp.

Core 5: Depth 450-460 feet; recovery 8 feet 6 inches.

Coarse siltstone interbedded with silty limestone in which only one ostracod specimen was found.

Ostracoda: Bythocypris sp. indet.

Core 6: Depth 548-558 feet; recovery 10 feet 0 inches.

Hard grey siltstone, which grades downwards into a silty limestone, in which only poorly preserved, internal casts of ostracods were found, since the adult carapaces were broken in the preparatory crushing process.

Ostracoda: Cavellina sp. indet.
Lochriella sp. indet.
Microcheilinella sp.
Tetratylus ? sp. indet.

Core 7: Depth 650-657 feet; recovery 3 feet 6 inches.

Arenaceous limestone containing a few immature ostracods.

Ostracoda: Cavellina sp. indet.
Microcheilinella sp.
Perprimitia sp.

Core 8: Depth 800-814 feet; recovery 5 feet 0 inches

White fine-grained calcareous sandstone, with some siltstone in which ostracods are common, and generally well preserved.

Ostracoda : Cavellina n. sp. 1
Lochriella n. sp. 1 aff. fenriri (Coryell & Johnson) 1939
Microcheilinella sp.

Core 9: Depth 900-912 feet; recovery 12 feet 0 inches.

Grey silty limestone, containing abundant well preserved ostracods.

Ostracoda: Cavellina n. sp. 1
Cavellina croneisi Coryell & Rozanski 1942
Lochriella n. sp. 1 aff. fenriri (Coryell & Johnson) 1939

Core 10: Depth 1000-1010 feet; recovery 7 feet 3 inches.

White coarse silty calcilutite resting on a grey limestone, which contains a few, well preserved ostracods.

Ostracoda: Bythocypris ovata Cooper 1941
Microcheilinella obesa Cooper 1941
Microcheilinella n. sp.

Core 11: Depth 1090-1100 feet; recovery 9 feet 6 inches.

Grey micaceous siltstone, grading downwards into a medium-grained sandstone which becomes coarse near the base. No fossils found.

Core 12: Depth 1200-1210 feet; recovery 10 feet 0 inches.

Grey calcareous siltstone interbedded with a coarse white calcareous sandstone. No fossils found.

Core 13: Depth 1300-1310 feet; recovery 5 feet 6 inches.

White fine-grained calcarenite with bands of calcareous siltstone. Small fragments of brachiopods were found in the middle of the core. No ostracods were found.

Core 14: Depth 1400-1410 feet; recovery 7 feet 6 inches.

Fine-grained calcarenite and thin beds of green siltstone, containing a few indeterminate ostracod fragments.

Core 15: Depth 1500-1510 feet; recovery 6 feet 6 inches.

Grey dolomitic sandstone grading downwards into a fine-grained micaceous, quartz sandstone. No fossils found.

Core 16: Depth 1600-1610 feet; recovery 1 foot 3 inches.

Very fine-grained brown dolomite. No fossils found.

Core 17: Depth 1696-1707 feet; recovery 5 feet 0 inches.

Medium-grained quartz sandstone. No fossils found.

Core 18: Depth 1775-1785 feet; recovery 9 feet 6 inches.

Grey limestone, in which ostracods are common, but in view of their poor preservation the following identifications must be regarded as tentative.

Ostracoda: Cavellina sp.
Cavellina n. sp. 2
Glyptopleura n. sp. cf. parvacostata Geis 1932
Lochriella n. sp. 1 aff. fenriri (Coryell & Johnson) 1939

Conchostraca: Rhabdostichus

Core 19: Depth 1923-1929 feet; recovery 6 feet 0 inches.

Interbedded green and red mottled siltstone. No fossils found.

Core 20: Depth 1929-1935½ feet; recovery 6 feet 6 inches.

Red laminated siltstone, grading downwards into a green siltstone. No fossils found.

Core 21: Depth 2033-2041 feet; recovery nil. No sample sent for examination.

Core 22: Depth 2041-2043 feet; recovery 2 feet 0 inches.

Red siltstone, with polished slickensided surfaces. No fossils found.

Core 23: Depth 2129-2139 feet; recovery 6 feet 3 inches.

Green siltstone, the lower part of which contains inclusions of clay pellets which give an appearance reminiscent of cornstones found in the Old Red Sandstone of the Welsh Borderlands. Ostracods are abundant, but are mostly immature specimens of Phlyctiscapha. Adult females of Phlyctiscapha are present, which are tentatively identified as Phlyctiscapha rockportensis Kesling 1953.

Core 24: Depth 2207-2217 feet; recovery 7 feet 0 inches.

Red mottled siltstone interbedded with green siltstone containing plant streaks. No fossils found.

Core 25: Depth 2294-2304 feet; recovery 7 feet 5 inches.

Green siltstone, containing a few indeterminate ostracods.

Core 26: Depth 2391-2401 feet; recovery 3 feet 11 inches.

Green-grey siltstone. No fossils found.

Cuttings from 2385-2390 feet yielded the following microfossils:

Ostracoda: Phlyctiscapha sp.
Cavellina n. sp. 2
Glyptopleura n. sp. cf. parvacostata
n.gen. et sp.? (in family Primitiidae)

Conchostraca: Rhabdostichus n. sp.

Core 27: Depth 2490-2499 feet; recovery 5 feet 9 inches.

Green and mottled siltstone, passing downwards into red siltstone with a dark green finely laminated siltstone containing plant streaks at the base of core. No fossils found.

Core 28: Depth 2580-2590 feet; recovery 8 feet 0 inches.

Finely laminated, interbedded green and red siltstone. No fossils found.

Cuttings from 2560-2565 feet yielded the following species:-

Ostracoda: Cavellina n. sp. 1
Cavellina n. sp. 2
Phlyctiscapha sp.
Primitia sp.
n.gen. et sp.? (as in cuttings 2385-2390 feet).

Core 29: Depth 2700-2706 feet; recovery 2 feet 0 inches.

Red and green mottled siltstone, containing poorly preserved ostracods (steinkerns and broken carapaces).

Ostracoda: Paraparchites? sp. indet.

Core 30: Depth 2800-2810 feet; recovery 5 feet 9 inches.

Grey silty limestone with plant streaks. Well preserved ostracods are common, usually replaced by calcite, but specimens are difficult to extract.

Ostracoda: Cavellina n. sp. 1
Cavellina n. sp. 2
Paraparchites inornatus (McCoy) 1844
Phlyctiscapha sp.

Core 31: Depth 2890-2896 feet; recovery 2 feet 7 inches.

Grey silty limestone containing very few ostracods.

Ostracoda: Cavellina sp. indet.

Core 32: Depth 2896-2902 feet; recovery 2 feet 6 inches

Grey-green siltstone with a grey silty limestone at the base of core, in which ostracods are common.

Ostracoda: Cavellina sp.
Paraparchites inornatus (McCoy) 1844
Phlyctiscapha cf. rockportensis Kesling 1953
Phlyctiscapha n. sp.

Core 33: Depth 3000-3010 feet; recovery 0 feet 2 inches.

Red siltstone with greenish inclusions. No fossils found. Cuttings from 3009 feet yielded the following species:-

Ostracoda: Glyptopleura n. sp. cf. parvacostata Geis 1932
Paraparchites okeni (Munster) 1830
Phlyctiscapha sp.
Primitia sp.

Core 34: Depth 3010-3013 feet: recovery 10 feet 6 inches, which includes most of core 33. Dark green well bedded siltstone, overlying silty limestone containing bryozoa, the annelid Spirorbis, and abundant ostracods which are difficult to extract.

Ostracoda: Cavellina n. sp. 1
Glyptopleura n. sp. cf. parvacostata
Jonesina crategera ? (Jones & Kirkby) 1886
Paraparchites inornatus (McCoy) 1844
Paraparchites okeni (Munster) 1830
Phlyctiscapha sp.
Primitia sp.

Conchostraca: Rhabdostichus ?

Core 35: Depth 3100-3110 feet; recovery 1 foot 6 inches.

Purple siltstone overlying dark green fossiliferous siltstone, which contains abundant, well preserved ostracods.

Ostracoda: Phlyctiscapha rockportensis Kesling 1953

Core 36: Depth 3160-3170 feet; recovery 5 feet 6 inches.

Green fossiliferous siltstone grading downwards into an interbedded red, green and white siltstone. Ostracods common, although mainly immature forms.

Ostracoda: Paraparchites inornatus (McCoy) 1844 ?
Phlyctiscapha rockportensis Kesling 1953
Phlyctiscapha n. sp.

Core 37: Depth 3255-3265 feet; recovery 6 feet 6 inches.

Green siltstone containing many ostracods and the annelid Spirorbis, capped with red shaly, mottled siltstone at top of core.

Ostracoda: Paraparchites cf. okeni (Munster) 1830

Core 38: Depth 3344-3354 feet; recovery 9 feet 6 inches.

Interbedded green and red siltstone. No fossils found.

Core 39: Depth 3500-3509 feet; recovery 8 feet 0 inches.

Slickensided green siltstone passing downwards into a finely interbedded green siltstone and micaceous fine-grained, light grey sandstone. Ostracods rare; only one poorly preserved, indeterminate specimen found.

Core 40: Depth 3580-3586 feet; recovery 3 feet 3 inches.

Interlaminated fine-grained light grey-brown quartz sandstone, and coarse micaceous dark grey siltstone. No fossils found.

Core 41: Depth 3715-3725 feet; recovery 8 feet 8 inches.

Fine-grained light grey-brown sandstone with silty micaceous partings. No fossils found.

Core 42: Depth 3800-3810 feet; recovery 10 feet 4 inches.

Finely interbedded light grey, fine-grained sandstone and grey siltstone. Ostracods rare; only two very poorly preserved indeterminate specimens found.

Core 43: Depth 3890-3900 feet; recovery 10 feet 0 inches.

Grey-green shaly micaceous siltstone, containing shell fragments (Spiriferids ?), and a few poorly preserved, indeterminate ostracods.

Ostracoda: Leperditella ? sp.

Core 44: Depth 3980-3990 feet; recovery 10 feet 0 inches.

Dark green micaceous siltstone. No fossils found.

Core 45: Depth 3990-4000 feet; recovery 8 feet 2 inches.

Dark green micaceous siltstone, with thin lenses of white fine-grained sandstone. No fossils found.

3. NOTES ON OSTRACOD ASSEMBLAGES, AND TENTATIVE AGE RELATIONSHIPS.

There appears to be three distinct assemblages present.

Assemblage 1 Characterised by Cavellina, Cryptophyllus and Paraparchites, between 150 feet and 360 feet.

Assemblage 2 Characterised by Microcheilinella between 548 feet and 1010 feet.

Assemblage 3 Characterised by Phlyctiscapha between 2129 feet and 3170 feet.

Assemblage 1. The species of Cavellina, C. coryelli, C. croneisi, C. cf. geisi, C. ovatiformis and C. parallela are broadly confined to the strata between 250 feet and 360 feet. Cryptophyllus n. sp. is confined to the strata between 150 feet and 360 feet, and the species of Paraparchites, P. cf. distortus, P. inornatus, P. nicklesi, and P. symmetricus apparently confined to core 4, 350-360 feet.

With the exception of Cryptophyllus n. sp. and Paraparchites symmetricus, all the above mentioned species of this assemblage are characteristic of the Chester formations (see Table 1) of Upper Mississippian (Lower Carboniferous) age of the United States (Cooper 1941).

Assemblage 2. The strata between 548 feet and 1010 feet appear to be characterised by the presence of Microcheilinella obesa and Microcheilinella spp. Microcheilinella obesa has been previously found in the Chester formations of Upper Mississippian (Lower Carboniferous) age of the United States (Cooper 1941).

Between the depths of 650 feet and 657 feet, Perprimitia sp. is associated with species of Microcheilinella and Cavellina. In the United States the genus Perprimitia occurs throughout the Chester formations of the Upper Mississippian.

Assemblage 3. The genus Phlyctiscapha is represented by P. rockportensis and Phlyctiscapha spp., the presence of which characterises the lower part of the bore between the depths of 2129 feet and 3170 feet. In these cores, this assemblage of ostracoda is closely associated with the conchostracan genus Rhabdostichus. Phlyctiscapha has been previously found in Middle Devonian strata of the United States (Kesling 1953-4, Smith 1956). Rhabdostichus has been reported from doubtful Silurian strata in Britanny, the Middle Devonian (Hamilton Group) of the United States (Raymond 1946), and has been recently found in the Upper Devonian of the Williston Basin of the United States and Canada (Wilson 1956).

Tentative Age Relationships

Cores	Depth in feet	Age	Age, European scale
1	50 - 60	?	
2	150 - 162	? Lower Carboniferous ?	
3-10	250 - 1010	Lower Carboniferous, (Upper Mississippian) (Chester)	Early Namurian and Late Visean
11-17	1090 - 1707	?	
18	1775 - 1785	? Devonian ?	
19-22	1923 - 2043	?	
23-37	2129 - 3265	Devonian	
38-45	3344 - 4000	?	

4. NOTES ON THE OSTRACOD GENERA AND SPECIES.

Only one specimen has been identified as belonging to the genus Bythocypris, B. ovata Cooper 1941, a species restricted to the Paint Creek formation (Lower Chesterian) of the United States. The species of Bythocypris present difficulties in identification, since many species lack distinctive characteristics.

The following species of Cavellina were recognised:- C. ovatiformis (Ulrich) 1891, C. parallela Croneis & Gutke 1939, C. croneisi Coryell & Rozanski 1942, C. coryelli Croneis & Gale 1938, C. cf. geisi (Croneis & Gale) 1938, and two new species. C. ovatiformis occurs in the United States in the Upper Mississippian, mainly in the upper Chester formations. C. parallela occurs in the Upper Mississippian, in the lower Chester formations of the United States. C. croneisi occurs in the United States in the Upper Mississippian, in the upper part of the lower Chesterian (Glen Dean formation). C. coryelli occurs in the Upper Mississippian, in the Clore (Upper Chester) and Golconda (Lower Chester) formations. C. geisi occurs in the Vienna and Golconda formations, of Upper Mississippian (Chester) age. Cavellina n. sp. 1 is found in cores 3, 8, 9, 30 and 34, (between the depths 250 feet and 3013 feet, and in cuttings between the depths 2560 feet and 2565 feet, and is apparently a long ranging species. Cavellina n. sp. 2 is found in core 30 (depth 2800-2810 feet), and in cuttings from 2385-2390 feet, and 2560-2565 feet. The genus Cavellina is a smooth Cytherellid form which often presents difficulties in specific identification, since many species can only be distinguished from their allies by very slight changes in the outline of the carapace. Therefore if any doubt exists concerning the identification of a species of Cavellina, it cannot be used for age determination. In addition to the difficulties involved in specific differentiation, identifications based on worn specimens must be regarded as tentative, and in many cases poor preservation renders specific (and sometimes generic)

identification impossible.

Numerous, well preserved valves of a new form already identified from outcrop samples of the Laurel Beds are present in cores 2, 3, and 4 (depths 150-360 feet). This form has been identified as a conchostracan by Thomas in his preliminary examination of the cores taken between the depths of 140 feet to 253 feet, from B.M.R. Bore No. 2, Laurel Downs. It has also been identified by Dickins as a conchostracan from the Grant Range No. 1 bore at the depths 9796-9799 feet in Upper Carboniferous (Westphalian) strata, and has been previously reported from the Gneudna Formation, the Pelican Hill (Carnarvon) bore, and the Cape Cuvier bore as ? Pelecypoda Nucula ? sp. Examination of many specimens showed that in external view and thin section, this form closely resembles the ostracod genus Cryptophyllus Levinson 1951. An outstanding feature of the specimens of this form, is the presence of a distinct internal ridge, which is apparently absent in ostracods. However, the interior of the type species of the genus Cryptophyllus, (Eridoconcha oboloides Ulrich & Bassler) has not been described. Therefore it would appear that there is some doubt as to whether the genus Cryptophyllus should be included in the Ostracoda. The taxonomic problem as to whether this form belongs to the Ostracoda, or to the Conchostraca, or to some other group, can only be solved by further investigation. In the United States, Cryptophyllus occurs in Ordovician, Silurian and Middle Devonian strata, and in Germany it occurs in the Upper Devonian (Frasnian). It has not been possible at the present stage, to make any differentiation at specific level between the Western Australian Upper Devonian and Carboniferous forms of Cryptophyllus. It has not been found in the Carboniferous of the Carnarvon Basin, nor in the Devonian of the Fitzroy area of the Canning Basin. More fossiliferous surface samples of known Carboniferous and Devonian ages need to be collected from these areas before any conclusions on the local stratigraphical ranges of Cryptophyllus n. sp. can be formed.

One undescribed species of Glyptopleura, which shows marked sexual dimorphism and a slight resemblance to G. parvacostata Geis 1933, was found in core 34 (3010-3013 feet). G. parvacostata is recorded from the Salem Formation (Lower Meramecian) of Upper Mississippian. Since the species found in Bore B.M.R. No. 2 is new, it cannot indicate any particular age. Until 1952 the genus Glyptopleura was only known from Carboniferous and Lower Permian strata, but the work of Kesling & Kilgore 1952, Kesling & Weiss 1953, and Pribyl 1953 has shown that representatives of this genus can occur in the Middle Devonian.

Several specimens that have been tentatively assigned to the species Jonesina crategera (Jones & Kirkby) 1886, were found in core 34 (3010-3013 feet). J. crategera is recorded from the Lower Carboniferous of England and Scotland, and Cooper (1941) recognised this species in the Glen Dean and Golconda Formations of the Chester Series. This species, if correctly identified, would indicate a Lower Carboniferous element in the Devonian part of the Bore B.M.R. No. 2.

One specimen of ostracod in core 42 (3806-3810 feet) has been doubtfully referred to Leperditella, a genus mainly confined to the Ordovician, but known to range into the Devonian.

Two new species of the genus Lochriella were identified from the Bore B.M.R. No. 2. Lochriella n. sp. 1 was found between the depths of 250 feet and 1785 feet, and shows some affinity to Lochriella fenriri (Coryell & Johnson) 1939, a species known from the Clore Formation, of the Upper Chester (Upper Mississippian). Lochriella n. sp. 2

appears to be restricted to core 3 (250-260 feet). According to Cooper (1941 p.57) the morphology of Lochriella is intermediate between that of Sansabella and Neokloedenella, and his views have proved useful in diagnosing the presence of the former genus in the upper part (250-1785 feet) of Bore B.M.R. No. 2, and in a sample of the Laurel Beds. In the United States Lochriella is found in both the Mississippian and Pennsylvanian, but does not appear to have been found below the Upper Mississippian.

Only one species of the genus Microcheilinella has been recognised in this bore, namely M. obesa Cooper 1941, which occurs in core 10 (1000-1010 feet). Cooper found this species in the Kinkaid and Menard Formations (Upper Chesterian), and the Paint Creek Formation (Lower Chesterian). The only other species of Microcheilinella found in core 10 appears to be an undescribed form which shows a slight resemblance to Microcheilinella ? exila Cooper 1941. As a genus, Microcheilinella ranges from the Devonian (possibly Silurian to the Lower Permian.

Six species of the genus Paraparchites have been found in core 4 (350-360 feet) namely, P. inornatus (McCoy) 1844, P. nicklesi (Ulrich) 1891, P. okeni (Munster) 1830, P. ovatus Cooper 1941, P. symmetricus Kummerow 1953, and P. cf. distortus Coryell & Rozanski 1942. The species P. cf. okeni and P. cf. inornatus have been found in the Upper Devonian (Frasnian) part of the Rough Range No. 1. bore, between the depths of 12,928 feet and 12,932 feet. Species of Paraparchites have been observed in a surface sample of the Laurel Beds are similar to those found in the Chester formations (Upper Mississippian) of North America. The genus Paraparchites was first recognised in Western Australia by Teichert (in Condon 1954), in the type section of the Yindagindy Formation (Carboniferous) of the Carnarvon Basin.

P. inornatus occurs in the Lower Carboniferous of Great Britain, U.S.S.R., America, and Mongolia. Cooper (1946) has also recognised this species in the Pennsylvanian of Illinois. P. okeni occurs in the Carboniferous strata of Germany, U.S.S.R., and Nova Scotia, and in the Lower and Upper Carboniferous formations of the British Isles, and the Devonian (Givetian) of Belgium. Cooper (1941) has only found the species P. ovatus in the Clore Formation (Upper Chesterian) of the Upper Mississippian. P. nicklesi is a Mississippian form which ranges from the Kinderhook Formation (lowest Mississippian) up to the Kinkaid Formation (highest Chester). P. distortus occurs in the Upper Mississippian, in the upper part of the Lower Chesterian (Glen Dean Formation). P. symmetricus is an Upper Carboniferous form from Poland. The generic range of Paraparchites commences in the Lower Devonian, attains its maximum development in the Upper Mississippian and Pennsylvanian, and ends in the Upper Permian.

Well preserved specimens of Phlyctiscapha rockportensis Kesling 1953, occur in core 35 (3100-3110 feet), and without doubt can be referred to male forms. Specimens referred to female forms of Phlyctiscapha occur in core 23 (2129-2139 feet), and are tentatively assigned to P. rockportensis. Possibly a new species of the genus Phlyctiscapha is present in core 32 (2896-2902 feet). Phlyctiscapha is a nonsulcate beyrichiid, characterised by marked sexual dimorphism. As far as it is known, Phlyctiscapha is restricted to the Middle Devonian. Considering, however, the paucity of knowledge of the Upper Devonian ostracods of North America it may be possible that it ranges above the Middle Devonian.

The occurrence of Perprimitia sp. between the depths of 650 feet and 657 feet is of stratigraphical value, since in the United States this genus appears to be

restricted to the Upper Mississippian (Lower Carboniferous). Perprimitia was thought to be confined to the Chester formations but recently Crane and Kelly (1956) found representatives of this genus in the Bayport limestone of Michigan. On the basis of similar macrofossils and lithology, the Bayport limestone is thought by Ehlers and Humphrey (1944), to be the stratigraphical equivalent of the St. Louis limestone of Illinois and Indiana, which is older than Chester. If this correlation were correct, the earliest recorded occurrence of Perprimitia would be in the middle Meramec, of comparatively early Upper Mississippian age.

The species of Primitia found in Bore B.M.R. No. 2, could not be identified specifically; the genus has a long stratigraphical range from Lower Ordovician to Lower Permian, but it appears to be more representative in Lower Palaeozoic strata.

It may be possible that one of the specimens identified in core 6 (548-558 feet) belongs to the genus Tetratylus, but it does not possess the characteristic median sulcus of this genus. On the other hand, the absence of the sulcus could be explained by the bad preservation of the specimen. Cooper (1941) found the genus Tetratylus mainly confined to the Paint Creek Formation (Lower Chesterian), with the occurrence of one species in the Menard Formation (Upper Chesterian).

5. CONCLUSION.

The species of Paraparchites, Perprimitia, Cavellina, Microchelinella, and Bythocypris identified from between the depths of 250 feet and 1010 feet in Bore B.M.R. No. 2 are typically Lower Carboniferous, and show some affinity with the Chester ostracods of Illinois. This does not necessarily imply that the strata between 250 feet and 1010 feet can be correlated with the Chester formations of the United States, since American research on Lower Carboniferous ostracods appears to have been concentrated on the Upper Mississippian rather than the Lower Mississippian; therefore it is possible that many of the Chester ostracods may occur in the Lower Mississippian (Tournaisian). Also at the present time little is known about the ostracod faunas of the Lower Carboniferous of Western Australia to form any definite conclusion in order to decide whether the Lower Carboniferous sequence of Bore B.M.R. No. 2 from 250 feet to 1010 feet is Visean or Tournaisian in age. The worn specimens of Cavellina cf. ovatiformis in core 2 (150-162 feet) are not considered to be reworked from the lower beds, since they are composed of the same lithology as the core sample in which they were found. Therefore if the identification of these specimens is correct, then it is possible that core 2 (150 - 162 feet) is of a Lower Carboniferous age also.

It is not possible to reach any definite conclusions concerning the ages of the strata between the depths of 1010 feet and 2129 feet, due to the paucity of identifiable microfossils. The species of Cavellina, Glyptopleura, and Lochriella found in core 18 (1775-1785 feet) are undescribed forms, and therefore of little value at present for age determination. The presence of the conchostracan genus Rhabdostichus found in the strata between the depths of 1775 feet and 1785 feet may possibly indicate a Devonian age, but until more is known concerning the stratigraphical ranges of the Upper Palaeozoic ostracods and conchostracans of Western Australia, one must refrain from drawing any definite conclusions.

The presence of species of Phlyctiscapha together with the conchostracan Rhabdostichus found in the strata below 2129 feet is a good indication of Devonian age. In this part of the bore there are ostracod species, Cavellina n. sp. 1, and Paraparchites inornatus which range into the overlying

Carboniferous strata. A species resembling Paraparchites inornatus, however, has been recognised in the Rough Range No. 1 bore at 12,928-12,932 feet of known Upper Devonian (Frasnian) age. It is difficult to decide whether the strata below 2129 feet are Upper Devonian age, because of the absence of typical Upper Devonian ostracods e.g., those included in the superfamily Entomozoacea Pribyl 1951. However, the fact that a Carboniferous element (e.g. Paraparchites inornatus) is present, indicates that the strata below 2129 feet may possibly be younger than Middle Devonian. On the other hand, Pribyl (1953-4) has observed a North American Carboniferous element in the Middle Devonian strata of Bohemia and Poland. The possible Upper Devonian age of the strata below 2129 feet can only be confirmed by further work on Upper Devonian material collected from outcrop.

6. REFERENCES.

Condon, M. A., 1954 — Progress Report on the Stratigraphy and Structure of the Carnarvon Basin, Western Australia. Bur.Min.Resour.Aust. Rep. 15, 1-163.

Cooper, C.L., 1941 — Chester Ostracodes of Illinois. Illinois geol. Surv. Rep. Invest. 77, 1-101.

Cooper, C.L., 1946 — Pennsylvanian Ostracodes of Illinois. Illinois geol. Surv. Bull. 70, 1-177.

Crane M.J. & Kelly W.A. 1956 — A new occurrence of Mississippian Ostracoda in Michigan. J.Paleont. 30, (4), 869-875.

Ehlers G.M. & Humphrey W.E., 1944 — Revision of E.A.Strong's species from the Mississippian Point Au Gres limestone of Grand Rapids, Michigan. Contr.Mus. Paleont.Univ.Michigan. 6, 113-130.

Ellis B.F. & Messina A.R., 1952-1956. — Catalogue of Ostracoda. Amer.Mus.Nat. Hist.Spec.Pub.

Kesling R.V., 1953. — A new beyrichiid ostracod from the Middle Devonian Rockport Quarry Limestone of Michigan. Contr.Mus.Paleont.Univ. Michigan. 10 (10) 221-9.

Kummerow E., 1953. — Uber oberkarbonische und devonische Ostracoden in Deutschland und in der Volksrepublik Polen. Geologie vol. 2, Beiheft no. 7. 1-75.

Levinson, S.A., 1951. — Thin sections of Paleozoic Ostracoda and their bearing on Taxonomy and Morphology. J.Paleont. 25 (5), 553-560.

Pribyl, A., 1953. — The Ostracodes of the Middle Devonian (Givetian) of Poland in the Profile Grzegorzewice-Skaly in the Gory Swietokrzskie (St.Croix Mountains). Sborn.Ustred.Ustravn.Geol.paleont. 20, 81-112.

Pribyl, A., 1954. — A contribution to the study of the Ostracods of the Bohemian Devonian and their Stratigraphical Significance. Sborn.Ustred.Ustravn.Geol.paleont. 21, 98-141.

Raymond, P.E., 1946. — The Genera of Fossil Conchostraca - an order of bivalved Crustacea. Bull.Mus. comp.Zool,Harvard, 96 (3) 218-307.

Smith, M.L., 1956. Some ostracods from the Middle Devonian Ledyard and Wanakah members of the Ludlowville formation in Western New York. J.Paleont. 30 (1) 1-8.

Wilson, J.L., 1956. Stratigraphic position of the Upper Devonian Branchiopod Rhabdostichus in the Williston Basin. J.Paleont. 30 (4) 959-965.

SPECIES IDENTIFIED	DEPTH (feet)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
	CORE NUMBER																																												
		50-60	150-162	250-260	350-360	450-460	548-558	650-657	800-814	900-912	1000-1010	1090-1100	1200-1210	1300-1310	1400-1410	1500-1510	1600-1610	1697-1707	1775-1785	1923-1929	1929-1935½	2011-2043	2129-2139	2207-2217	2294-2304	2391-2401	2490-2499	2580-2590	2700-2706	2800-2810	2890-2896	2896-2902	3000-3010	3010-3013	3100-3110	3160-3170	3255-3265	3344-3354	3500-3509	3580-3586	3715-3725	3800-3810	3890-3900	3980-3990	3990-4000
Bythocypris ovata						v					v																																	
B. sp.																																												
Cavellina coryelli					v	v																																						
C. croneisi						v																																						
C. cf. geisi				v																																								
C. ovatiformis			o	f																																								
C. parallela					v																																							
C. n. sp. 1				f					o	a																	v		f				a										
C. n. sp. 2																			f							r	r		f														
C. spp.			v	r			v	o											a												v	a											
Cryptophyllus n. sp.			o	a	r																					r																	
Glyptopleura n. sp. cf. parvacostata																			v													r	f										
Jonesina crategera ?																																		r										
Leperditella ? sp.																																										v		
Lochriella n. sp. 1 aff fenriri				o	r				r	a									v																									
L. n. sp. 2				r																																								
L. sp.							v																																					
Microcheilinella obesa											v																																	
M. n. sp.											v																																	
M. sp.					v		r	f	v																																		
Paraparchites cf. distortus					v																																							
P. inornatus					v																								r		r		f										
P. nicklesi					v																																							
P. okeni																																f	r			o							
P. ovatus					v																																							
P. symmetricus					r																																							
P. sp.					r																								f	v														
Perprimitia sp.								v																																				
Rhytetiscapha rockportensis																						s									f				a	o							
P. n. sp.																															v					v								
P. sp.																										r	r				f	f											
Primitia sp.																											r					r	r											
Rhabdostichus (conchostracan)																			v							r							v											
Tetratylus							v																																					
TENTATIVE AGE RELATIONSHIPS			? C_1 ?	C1	C_1			C_1		C_1	C_1	?	?	?	?	?	?	?	? D ?	?	?	?	D			D				D			D	D		? D ?	?		?	?	?	?		?	?	?

An underlined frequency symbol indicates species obtained from cuttings.

KEY TO SYMBOLS USED ABOVE

a = abundant (> 25 per sample)
c = common (11-25 " " "
f = frequent (6-10 " " "
r = rare (3-5 " " "
v = very rare (1-2 " " "

C_1 = Lower Carboniferous (Chester)
Upper Mississippian

D = Devonian

TABLE I.

8. Standard Sections of North American and European Lower Carboniferous

Approximate correlation between North American and European Stages after Moore, Lalicker and Fischer - 1952 - "Invertebrate Fossils".

NORTH AMERICA			EUROPE	
UPPER MISSISSIPPIAN	Chester	Kinkaid Formation Degonia Sandstone Clore Formation Palestine Sandstone Menard Formation Waltersburg Sandstone Vienna Formation Tar Springs Sandstone Glen Dean Formation Hardinsburg Sandstone Golconda Formation Cypress Sandstone Paint Creek Formation Bethel Sandstone Renault Formation Aux Vases Sandstone	Namurian	CARBONIFEROUS
	Meramec	Ste. Genevieve	Viséan	
		St. Louis		
		Salem (Spergen)	? ? ?	
LOWER MISSISSIPPIAN	Osage	Warsaw	Tournaisian	LOWER
		Keokuk		
		Burlington		
		Fern Glen		
	Kinderhook		? ? ? Etroeungtian	