

COMMONWEALTH OF AUSTRALIA

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DEPARTMENT OF NATIONAL DEVELOPMENT  
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GEOLOGY AND GEOPHYSICS

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INTERCONTINENTAL CONODONT CORRELATES OF THE PALAEOZOIC  
SEDIMENTS OF THE BONAPARTE GULF BASIN, NORTHWESTERN AUSTRALIA.

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by

P.J. Jones and E.C.Druce

The information contained in this report has been obtained by the Department of National Development, as part of the policy of the Commonwealth Government, to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

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In 1963, the Commonwealth Bureau of Mineral Resources began a detailed study of the geology of the Bonaparte Gulf Basin; the initial observations were recorded by Veevers, Roberts, Kaulback, & Jones (1964, see fig. 1 therein for the localities mentioned below). Previous published accounts of the geology include Traves (1955), and McWhae, Playford, Lindner, Glenister, & Balme (1958). Thomas (1962) summarized the knowledge of Carboniferous stratigraphy up to 1958; geological investigations prior to 1952 have been concisely reviewed by Noakes, Öpik, & Crespin (1952).

Conodonts were first discovered in the Bonaparte Gulf Basin by Öpik (1950, unpublished; in Traves, 1955, p. 57) who recorded the presence of a Lower Ordovician (Tremadocian) fauna in a glauconitic sandstone which he named the Pander Greensand. A preliminary study of our material supports Öpik's conclusion. Glenister (1960, p.214) noted the occurrence of Carboniferous conodonts in the upper parts of both the Burt Range Limestone (herein referred to as the Burt Range Formation) and the Septimus Limestone. The conodont locality (c) of Glenister (op. cit., p. 214), which he tentatively referred to the Spirit Hill Limestone, is on brachiopod evidence (Thomas, 1961, unpubl; 1962, p. 729), the same age as the Septimus Limestone.

Conodont zonations of European and North American Devonian and Carboniferous standard sections have been published by Bischoff (1957), Bischoff & Ziegler (1957), Collinson, Scott, & Rexroad (1962), and Ziegler (1962). British Carboniferous conodont faunas have been studied by Austin, Druce, & Rhodes (1966, in press). Information contained in these works has enabled us to correlate the Upper Palaeozoic succession of the Bonaparte Gulf Basin with the classical sections of the northern hemisphere (fig. 1). Such information will provide a stratigraphical framework for the detailed studies being conducted by the Bureau.

EUROPEAN STANDARD		BONAPARTE GULF BASIN		NORTH AMERICAN STANDARD	
UPPER CARB.	NAMURIAN (in part)	Point Spring Sandstone		CHESTER	
LOWER CARBONIFEROUS	VISÉAN	Cu III $\beta/\gamma$	"Unnamed Viséan Calcarenite"	STE. GENEVIEVE	VALMEYERAN
		Cu III $\infty$		ST. LOUIS	
		Cu II $\delta$		SALEM	
		Cu II $\beta/\gamma$		WARSAW	
	TOURNAISIAN			KEOKUK	
				BURLINGTON	
				FERN GLEN	
				"SEDALIA"	
				CHOUTEAU	
				HANNIBAL	
UPPER DEVONIAN	FAMENNIAN	to VI	"Unnamed formation"	"GLEN PARK"	UPPER DEVONIAN
		to V		LOUISIANA	
		to IV		SAVERTON	
	FRASNIAN	to III	?	GRASSY CREEK	
		to I	Cockatoo Sandstone	SYLAMORE	
MIDDLE DEVONIAN	GIVETIAN		?	ALTO	MIDDLE DEVONIAN
				LINGLE	

Fig.1 Intercontinental correlation of the formations of the Bonaparte Gulf Basin.

Note: Vertical hatching denotes apparent absence of time-rock units; thicknesses of formations not to scale

Detailed palaeontological studies of samples collected by a survey party led by J.J. Veevers, in 1963 have disclosed abundant conodont faunas in limestone formations previously known to contain conodonts. In addition, conodonts were discovered in the unnamed Visean calcarenite of Veevers et al., (1964, p. 354), in intercalated calcareous beds at the base of the Enga Sandstone and in a belt of limestone in the Ningbing region which Traves (1955, p.62) referred to the Burt Range Limestone.

Conodonts have only been recovered from the calcareous middle part of the Cockatoo Sandstone in the north-west part of the basin, at Westwood Creek. This fauna contains the species Ancyrognathus sp., Polygnathus cf. brevilamina Branson & Mehl, and Polygnathus normalis Miller & Youngquist, which indicate a Frasnian (toI) age. However, the upper boundary of the Cockatoo Sandstone may possibly be as young as the toII stage of the Famennian, because about 2,000 feet of sandstone which has so far yielded no conodonts overlies the fossiliferous limestones, and is in turn succeeded by the limestones of the Knob Peak area, of upper toII $\beta$  - lower toIII $\alpha$  age (see below, and fig. 1). Furthermore, the possibility that the non-fossiliferous basal beds may be of uppermost Middle Devonian age cannot be excluded.

Upper Devonian conodonts have also been discovered in limestones (Playford, Veevers, & Roberts, 1966 in press) exposed as a long narrow belt from Knob Peak southwards through Ninbing, to the east bank of the Ord River at Buttons Crossing (5.5 miles north of Ivanhoe Homestead). The presence of the conodont species Palmatolepis glabra elongata Holmes and P. glabra pectinata Ziegler indicates that these beds belong to the upper toII $\beta$  - lower toIII  $\alpha$  ammonoid zones of the German standard section. Traves (1955, p.62) and Veevers et al. (1964, p. 354 & fig.1) have referred these limestones to the Burt Range Formation.

The conodont faunas of the Burt Range Formation, however, include the species Polygnathus inornata E.R. Branson, Pseudopolygnathus sp. of the prima group and Siphonodella obsoleta Hass, which are comparable with those from the CuI-CuII ammonoid zones of the German standard section, and the Hannibal-Chouteau interval of the Upper Mississippi Valley. The presence of Siphonodella duplicata (Branson & Mehl) within the basal strata clearly shows that the Burt Range Formation is restricted to the Lower Carboniferous.

Therefore, our evidence shows that the limestones at Ninbing are older than the Burt Range Formation, and are separated from it by a considerable hiatus. These limestones constitute a hitherto unnamed formation, which will be described and named in a forthcoming publication of the Bureau.

The conodont faunas discovered in the basal beds of the Enga Sandstone include species found in the upper part of the Burt Range Formation, e.g., Polygnathus inornata E.R. Branson, and species of the genus Spathognathodus. These indicate a CuII age for the basal portion of the Enga Sandstone, which confirms the Tournaisian age previously assigned by Thomas (1962, p. 727), and the Kinderhookian age suggested by Öpik (in Traves, 1955, p.69).

The late Tournaisian to early Visean age of the Septimus Limestone, based on the brachiopod studies of Thomas (1961, unpubl; 1962, p.730), and Roberts (pers.comm.) is supported by our study of the conodonts. The fauna includes the species Polygnathus nodomarginata E.R. Branson and new and red~~e~~scribed species from the Z coral-brachiopod zone of the type Avonian at Bristol (Austin, Druce, & Rhodes, 1966, in press).

The unnamed Visean calcarenite of Veevers et al., (1964, p. 354) has yielded an abundant conodont fauna, including the species Geniculatus claviger Hass, Gnathodus girtyi Hass, G. texanus Roundy, Mestognathus beckmanni Bischoff, M. bipluti Higgins, and Spathognathodus scitulus (Hinde). This fauna indicates a CuIII age, although the presence of Gnathodus cf. G. cuneiformis Mehl & Thomas in the basal portions suggests that the formation may be as old as the CuII zone. The apparent absence of species characteristic of the late CuIII zone suggests that it is doubtful whether the top of the formation is any younger than the early part of this zone. In terms of the Upper Mississippi Valley standard succession (Collinson, Scott, & Rexroad, 1962), the formation can be correlated with part of the Valmeyeran stage; it is no older than the lower portion of the Burlington Formation, and no younger than the Ste. Genevieve Formation. Thus, the conodont evidence suggests a slightly younger age than the early Visean age assigned to it by Thomas (1965, p.101).

No conodonts have yet been found in calcareous samples of the Point Spring Sandstone; Thomas (1961, unpubl; 1965, p.101;), and Roberts (pers. comm.) indicate on brachiopod evidence, a late Visean to early Namurian age for this formation.

The systematics and biostratigraphy of the conodont faunas from the Upper Palaeozoic sequence of the Bonaparte Gulf Basin are being studied by one of us (E.C.D.) and similar studies on the Lower Palaeozoic succession are in progress (P.J.J.).

We gratefully acknowledge the co-operation of Drs. J.J. Veevers and J. Roberts for valuable discussions in the field on the stratigraphy and structure of the basin, and for systematically collecting conodont samples in measured sections. Dr. Günther Bischoff of Gewerkshaft Elwerath Erdölwerke, Hannover, West Germany, kindly spent valuable time in examination and discussion of the above faunas. Finally, none of this work would have been possible without the assistance of Mr. A.T. Wilson, who prepared and picked the residues.

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