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First documentation of similar Late Permian actinopterygian fish from Australia and South Africa

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INTRODUCTION

During a recent research visit to the Australian Museum, Sydney, the author identified an undescribed deep-bodied actinopterygian fish from the Rangal Coal Measures, Blackwater Group, Bowen Basin, Queensland, as being similar to a deep-bodied form from the Balfour Formation, Lower Beaufort Group, Karoo Basin, South Africa (Figures 1, 2, 3, 4 and 5). This discovery has important biogeographic implications since no comparable fossil remains are known from the Late Permian of the two regions. Furthermore, as the taxonomy of Palaeozoic deep-bodied fossil actinopterygians is not resolved (M.I. Coates pers. comm. 1997), detailed study of this inter-continentally similar form could prove important in this regard. The Rangal Coal Measures, uppermost formation in the Late Permian Blackwater Group, which contains several lacustrine mass mortality horizons (Leu 1989), has yielded abundant fossil fish remains but no other vertebrates. These include: the bobasatraniid *Ebenaqua ritchiei* (Campbell and Phuoc 1983), at least 12 new lower actinopterygian genera, and two new Elasmobranchii genera (Phuoc 1980; Leu 1989), with an enormous wealth of untapped, apparently easily accessible, additional material (M.R. Leu pers. comm. 1997). The Beaufort Group on the other hand, well known for its wealth and diversity of mammal-like reptiles and with eight biozones formally documented (Rubidge 1995), has yielded relatively few fossil fish remains. Up to now only the fish fauna from the Middle Triassic Bekkerskraal site in the Upper Beaufort Group has been well documented, with 18 palaeoniscoid species, a freshwater shark, three species of ceratotid lungfish and one coelacanth species (Broom 1909; Brough 1931, 1934; Hutchinson 1973, 1975, 1978). Recent research by the author at two hitherto essentially unresearched but rich Lower Beaufort fossil fish sites near Victoria West, Northern Cape and New Bethesda, Eastern Cape, respectively, both fluvio-lacustrine in origin (Johnson 1976; Le Roux and Keyser 1988), has yielded at least four new actinopterygian taxa, including the deep-bodied form mentioned above.

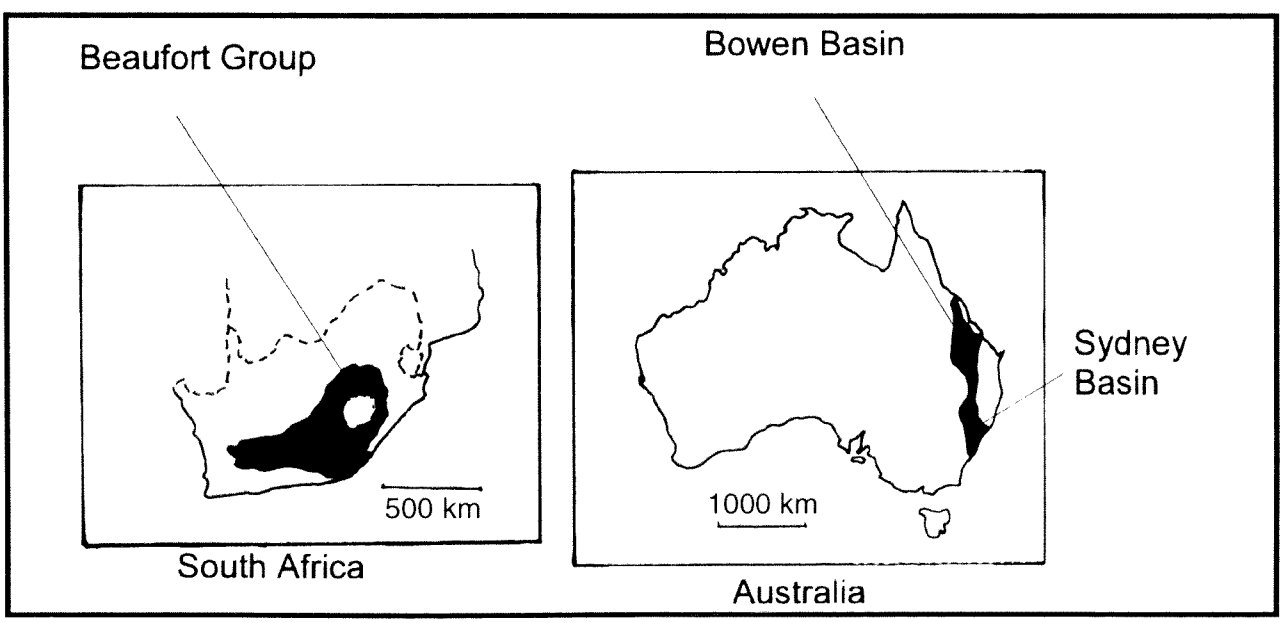

Figure 1 The Beaufort Group, South Africa and the Bowen Basin, Queensland, Australia.

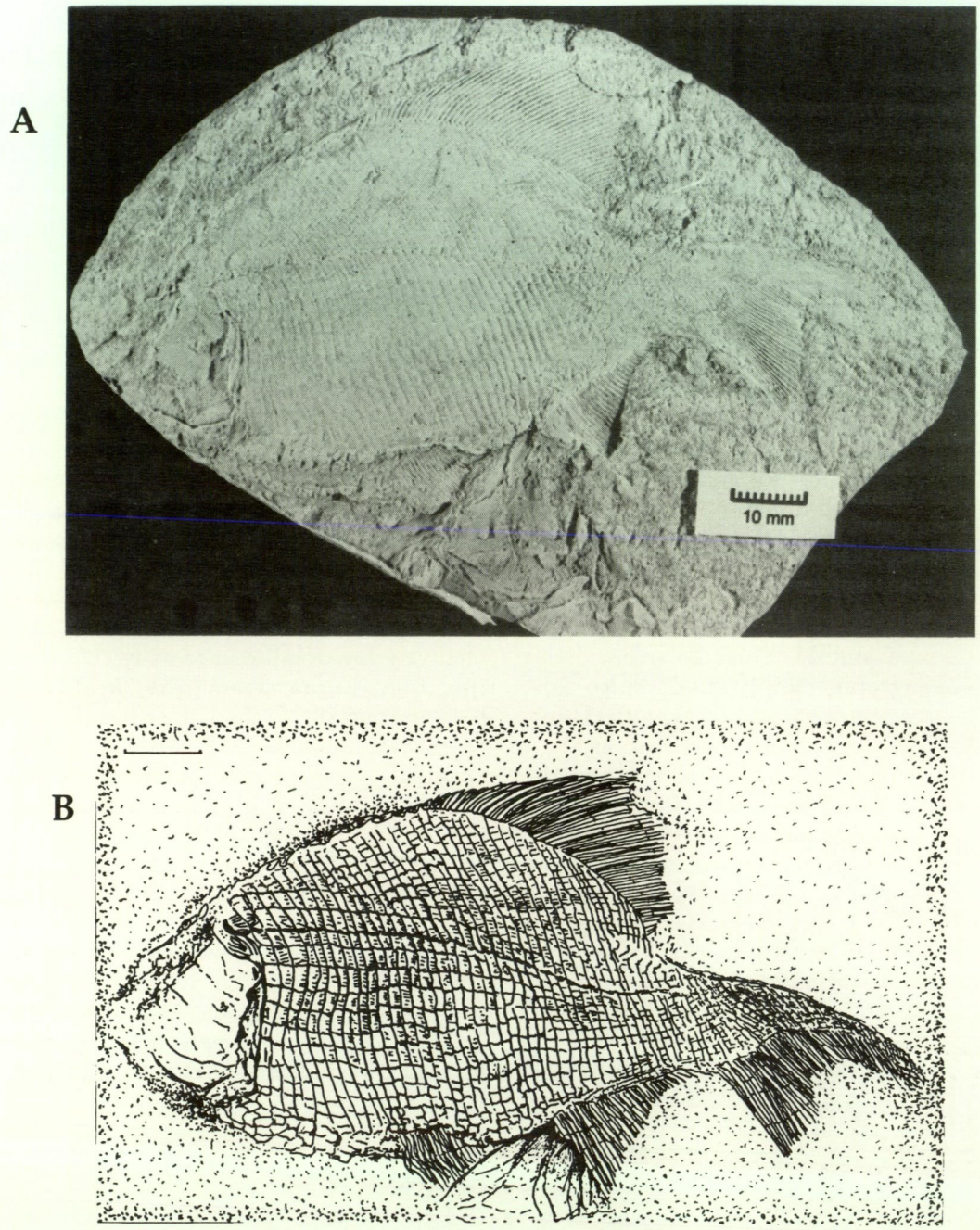

Figure 2 A, The Lower Beaufort, South African deep-bodied actinopterygian form (AK/76/2); B, Reconstruction of specimen AK/76/2. Scale bar = 10 mm.

PALAEONTOLOGY

The South African Lower Beaufort Group Deep-bodied Species

For the purposes of this article, three specimens (AK/76/2, PB/96/1 and PB/96/2), housed at the Council for Geoscience, Pretoria, South Africa, have been referred to (Figures 2, 4). This deep-bodied actinopterygian fish was originally identified by Woodward (1893) from the Fraserburg district, Northern Cape. It was subsequently noted at a number of other Lower Beaufort Group sites (spanning an area of some 1000 km^2), including sites at Blourug, Victoria West (Jubb and Gardiner 1975; Le Roux and Keyser 1988), and Wilgerbosch, New Bethesda. The species was previously known as *Atherstonia seeleyi*, but the genus cannot be included with the atherstoniids, and therefore a new generic name needs to be formalized. It is a relatively large species belonging to the "*Platysomus* Group" of Gardiner and Schaeffer (1989), with a total body length greater than 185 mm and the body just over 2½ times longer than deep. The maxilla has a large, triangular postorbital region and an elongate anterior blade. A broad dermopterotic, relatively large T-shaped dermosphenotic, large upright preopercular, and three to four suborbital bones are present. It also has a large jugal with a

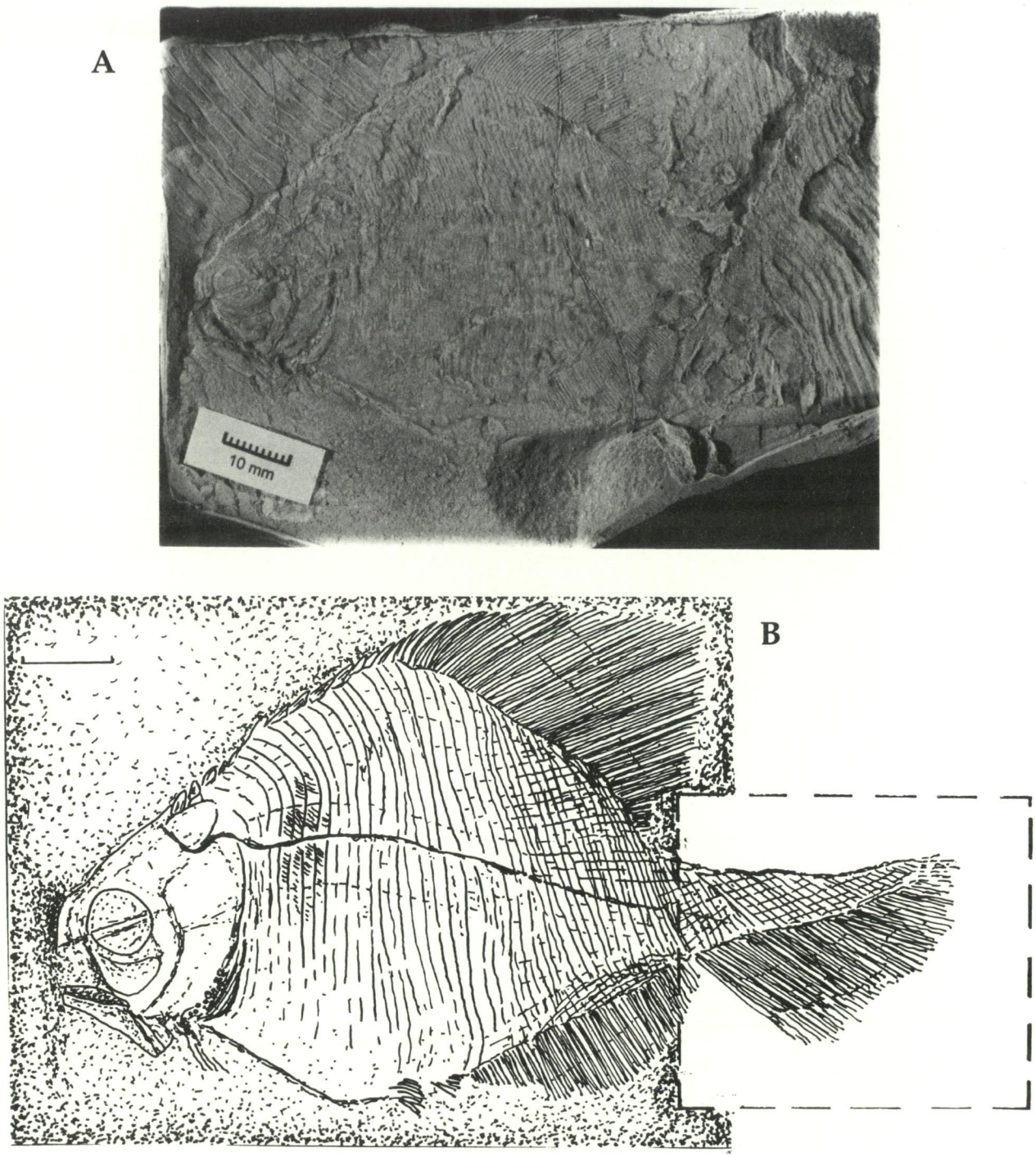

Figure 3 A, The Rangal Coal Measures, Australian deep-bodied actinopterygian form (F1339); B, Reconstruction of specimen F1339. Scale bar = 10 mm.

distinctive, enlarged infraorbital canal. The palate is known from pterygoidal fragments and is covered with granular teeth. The dentition consists of numerous small conical teeth, and fewer larger conical teeth (1 mm in height). The branchiostegal series consists of four to six rays. The leading edges of all fins consist of terminal lepidotrichia or fringing fulcra. All fins are relatively large, including a strongly heterocercal caudal fin with an extended epicordal lobe. The dermal squamation pattern appears to be diagnostic, with the mid-flank scales in particular exhibiting a well developed dermal ornamentation consisting of approximately 17 transverse ribs of ganoine, denticulated posteriorly. The dorsal fin is preceded by a series of ridge scales, a pair of anal scales precede the insertion of the anal fin.

Comparison with the Australian Rangal Coal Measures Deep-bodied Form

The Rangal Coal Measures specimens F1339, F95396, F95397, F95399, F95400, F95401 in the fossil

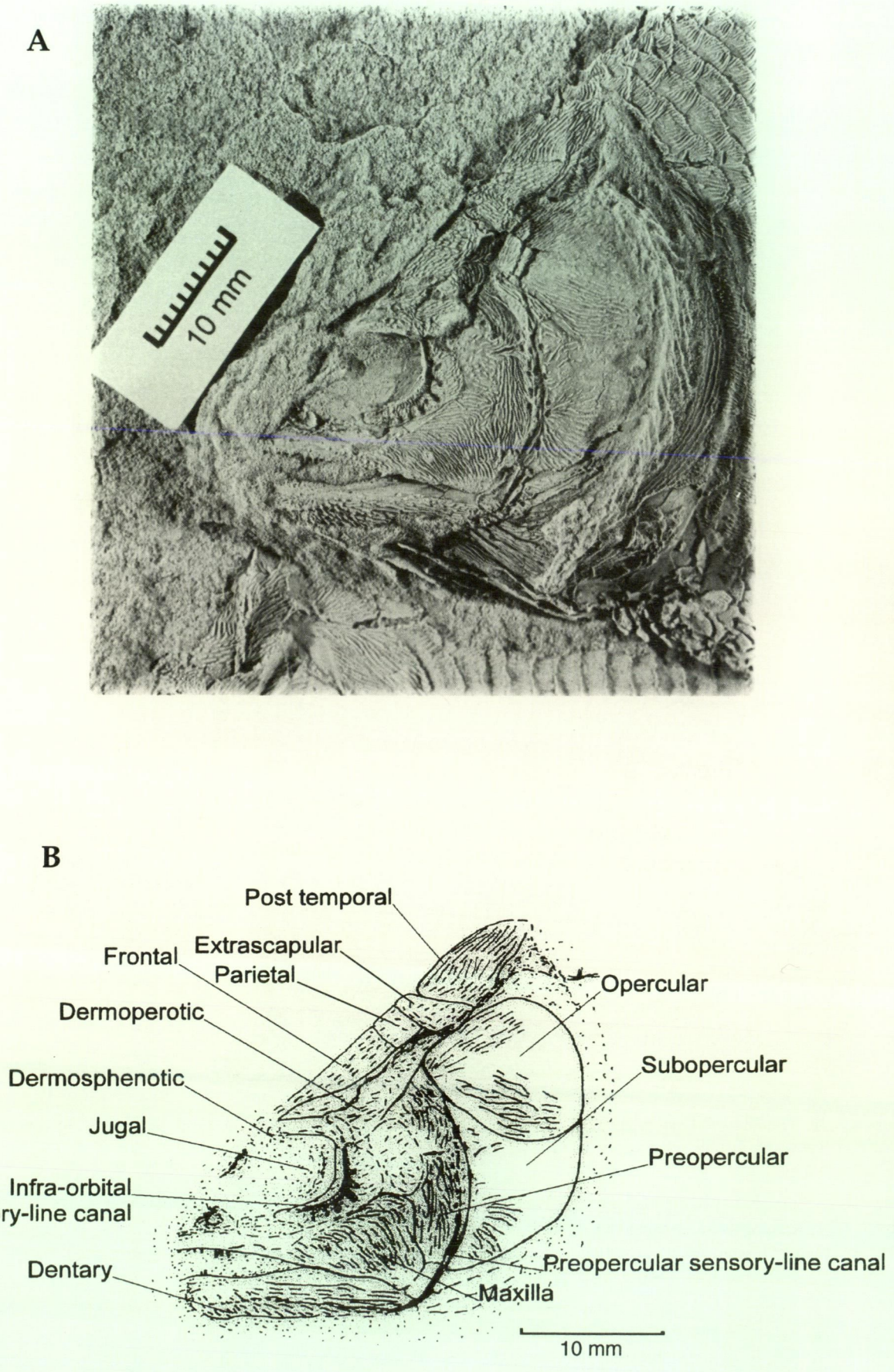

Figure 4 A, Lower Beaufort specimen PB/96/2 showing detail of the head; B, Reconstruction of specimen PB/96/2, showing head detail.

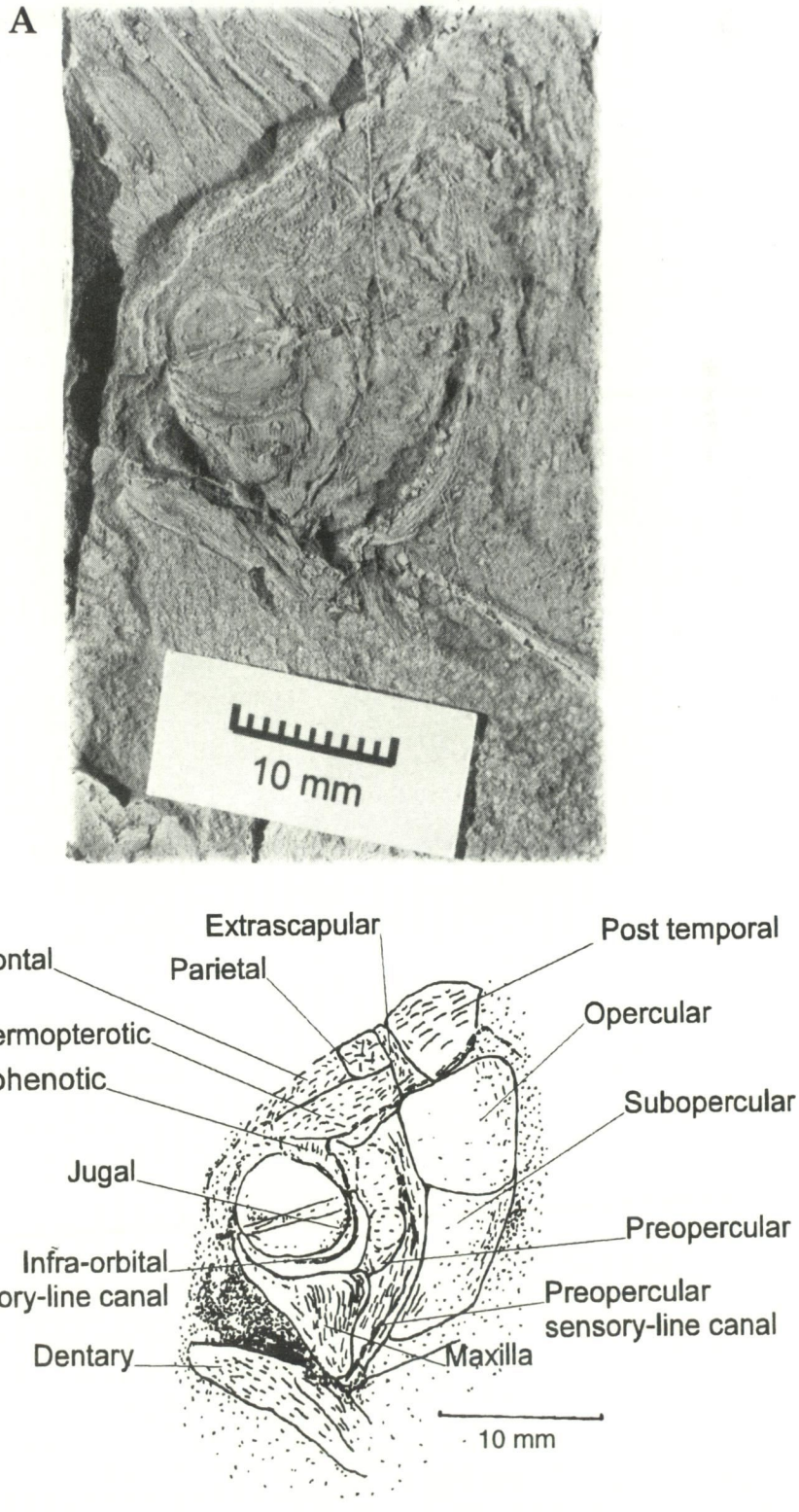

Figure 5 A, Rangal Coal measures specimen F1339 showing detail of the head; B, Reconstruction of specimen F1339, showing head detail.

collection of the Australian Museum, Sydney, Australia (Figures 3, 5) are anatomically similar to the three referred Lower Beaufort specimens. In particular with regard to the following characters: the shape of the maxilla with its triangular expanded postorbital region and elongate entire anterior blade; a relatively large upright preoperculum; a broad dermopterotic; the form, shape and relative sizes of the opercular and subopercular bones; relatively large fins, and a strongly heterocercal tail with an elongated epicordal lobe; the dorsal fin is also preceded by a series of ridge scales, and a pair of anal scales is present at the anal fin insertion. A number of

character differences is also apparent, including slight differences in head and body shape, dermal ornamentation on skull bones and scales; the variations in scale row formulae and slight differences in the shape of the maxilla.

DISCUSSION

From the above comparison it appears that Australia and South Africa probably share Permian deep-bodied actinopterygian forms at least at the family level. The type of skull morphology exhibited by these forms can be regarded as primitive (M.I. Coates pers. comm. 1997), and since the systematics of Palaeozoic deep-bodied actinopterygians is unresolved (M.I. Coates pers. comm. 1997), a future in-depth study of these forms would be a valuable contribution.

Palaeoichthyofaunal links between South Africa and Australia were probably first alluded to by Woodward (1902), when describing a new Carboniferous actinopterygian species from Harrington, New South Wales. Subsequently, Middle Triassic actinopterygian faunal elements were compared between the Sydney Basin and the Upper Beaufort Group of the South African Karoo Basin (Wade 1935; Hutchinson 1973, 1975, 1978). More recently Devonian ichthyofaunal links, based on a wealth of material, were established between South Africa and Australia (Chaloner *et al.* 1980; Anderson *et al.* 1994; Long *et al.* 1995, 1997). The later work is significant since it involves a number of different faunal elements correlated across much of Eastern Gondwana and South Africa. But in terms of Upper Palaeozoic ichthyofaunas, relatively little biostratigraphically correlative research has been published globally, although much work is in progress (J.A. Long pers. comm. 1997; S. Turner pers. comm. 1997). In the southern African region, Late Permian ichthyofaunal elements, including the actinopterygian genus *Atherstonia* have been used to establish links between the lower Sakamena Formation of southwest Madagascar and the *Dicynodon* Assemblage Zone of South Africa (Battail *et al.* 1987). Late Permian fossil fish faunas are also known to occur in a number of central, and other southern, African countries (Haughton 1934; Kemp 1975; Woodward 1903) and could prove useful in linking Upper Palaeozoic sedimentary deposits. If there is indeed a faunal link between the Bowen and Beaufort Group basins, then Afro-Australian fossil faunal links will have been considerably extended, from the Middle Triassic right down into the Permian. Much work is required on the Late Permian ichthyofaunas in the two basins, based on large undescribed collections made from both basins, and because there is a lot of scope for further collecting. The potential for biostratigraphic and biogeographic correlation between the basins is therefore clearly important, particularly bearing in mind that on a global scale Upper Palaeozoic ichthyofaunas have up to now been relatively neglected.

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