

SOME CASES OF FUSED AND CONCRESCENT EXOCRANIAL BONES IN THE LOWER PERMIAN SEYMOURIAMORPH TETRAPOD *DISCOSAURISCUS* KUHN, 1933

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ABSTRACT

An example of a parietal fused with an intertemporal and an example of concrescence of a parietal with an extra intertemporal in the metamorphic stages of the Lower Permian seymouriamorph are described. It is concluded that it is necessary to take account of phylogenetic fusion of two or more original components in the formation of the skull roofing bones in different phylogenetic lines of vertebrates ; and use this information when identifying homologous bones in various early tetrapod groups.

KEY-WORDS : TETRAPOD, SEYMOURIAMOPRH, PERMIAN, SKULL ROOF BONES, FUSIONS, HOMOLOGY.

RÉSUMÉ

Un exemple de fusion du pariétal et de l'intertemporal ainsi qu'un exemple de concroissance du pariétal et d'un extra intertemporal dans les stades de métamorphose du seymouriamorphe *Discosauriscus* du Permien inférieur sont décrits. On peut en conclure qu'il est nécessaire de tenir compte de la fusion phylogénétique de deux ou plus composants originaux dans la formation des os du toit crânien pour les différentes lignées phylogénétiques de vertébrés. Il est possible d'utiliser cette information pour identifier des os homologues dans des groupes différents de Tétrapodes primitifs.

MOTS-CLÉS : TÉTRAPODE, SEYMOURIAMORPHES, PERMIEN, TOIT CRÂNIEN, FUSIONS, HOMOLOGIES.

INTRODUCTION

Four categories of fusions and further examples of subdivisions of exocranial bones have been described in the Lower Permian seymouriamorph *Discosauriscus* (Klembara 1993). It has been shown recently (Klembara in press a) that the reptilomorph *Discosauriscus* is represented by early ontogenetic stages only. The aim of this paper is to present further recent discoveries of fusion and coalescence of skull roof bones in *Discosauriscus* which support the theory of phylogenetic fusion of bones (supported by evidence of ontogenetic fusion).

MATERIAL AND METHODS

The material and methods are described in Klembara & Meszáros (1992). The specimens

come from three Lower Permian localities [D, Vanovice (Drvalovice) ; K, Kochov-Horka ; L-KO, Kochov] of the Boskovice Furrow (Czech Republic). Specimens are deposited at the Faculty of Natural Sciences, Comenius University, Zoological Institute : D 207, D 43, K 6, K 80, KO 179.

DESCRIPTION

The concrescant and fusion of two bones are observable in the following specimens :

- specimen D 207. On its left side, the ornamented portion of a supplementary intertemporal (medially lying IT₂) has grown together with the parietal ; the intertemporal (IT₁) remains as a separate bone (Fig. 1). The suture between IT₂ and the parietal is clearly visible on the ventral side and between the unornamented surfaces dorsally. The supplementary intertemporal have distinct centers of growth.

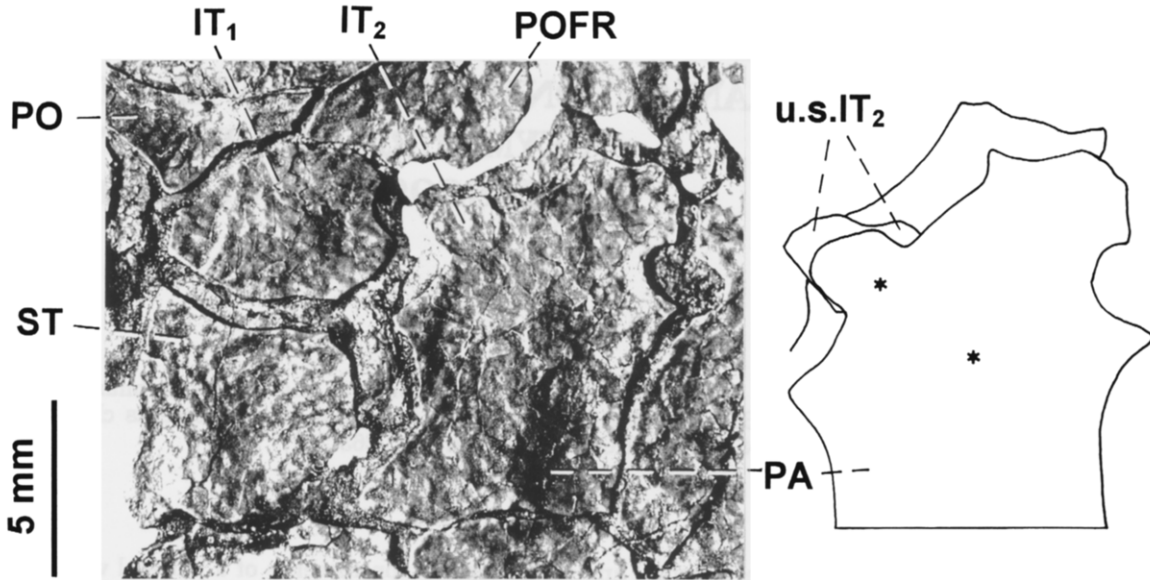


Figure 1 - *Discosauriscus austriacus* (MAKOWSKY, 1876), D 207. Left side skull roof in dorsal view with outlines (slightly enlarged) of conrescent IT_2 and parietals. Asterisk designates position of centers of growth. IT_1 , IT_2 , intertemporals 1 and 2; PA, parietal; PO, postorbital; POFR, postfrontal; ST, supratemporal; u.s. IT_2 unornamented surface of intertemporal 2. *Discosauriscus austriacus* (MAKOWSKY, 1876), D 207. Partie gauche d'un toit crânien en vue dorsale avec les contours, légèrement agrandis, d'un IT_2 et d'un pariétal concroissant. L'astérisque indique la position du centre d'ossification.

- specimen KO 179. On the right side of that specimen, the parietal and intertemporal are completely fused (Fig. 2A; cf. Klembara 1993, fig. 4). The common center of growth of this compound parieto-intertemporal bone is clearly visible. It lies about the midway between the normal positions of the parietal and intertemporal when compared to the left side of the skull roof.

COMPARISONS AND DISCUSSION

Several conclusions are inferred from the above data. An exoskeletal structure in which two individual centers of growth are recognizable (as represented in D 207) must be considered as a structure consisting of two bones (e.g. $IT_2 + PA$, in D 207; see also Jarvik 1972 : 147). The presence of two centers of growth in this structure does not represent evidence for phylogenetic fusion of two bones as suggested by Parrington (1956, 1967) and Panchen & Smithson (1987 : 412). Similar conditions to those of D 207 have been reported in the fronto-ethmoidal shield of some porolepiforms (Jarvik 1972 : 95).

In KO 179, it may be inferred that the ossification centers of the parietal and intertemporal moved together in the larval stage of ontogenesis and then fused. The common growing center of this compound parieto-intertemporal has a different position to the centers of the individual

left parietal and intertemporal. The same is true for the compound tabulo-postparietal of KO 43

(Fig. 2B) and the median postparietal of K 80 (Fig. 2C); see figure 3 for the ventral view of the skull roof of specimens KO 179, D 43 and K 80. Specimens KO 179, D 43 and K 80 represent individuals in the process of metamorphosis. Hence, the ontogenetic fusion of $IT+PA$, $TA+PP$ and $PP+PP$ supports the hypothesis of the phylogenetic fusion of two or more bones in the formation of the compound bone(s) (Jarvik 1948, 1967, 1972; Nelson 1969; Patterson 1977).

The absence of the compound parieto-intertemporal in KO 179 resembles the condition in porolepiforms (Jarvik 1972, 1980) however the holoptychiids situation is probably more complex (Jarvik 1967; Bjerring 1978). The lateral line canal was not influenced by the formation of the parieto-intertemporal in KO 179 probably because of some modifications in this skull roof region of *Discosauriscus* (Klembara in press b). Although such compound bones, as found in KO 179, D 43 and K 80, do not occur normally in the skull roofs of *Discosauriscus* or in adults of the closely related *Seymouria*, they suggest the process at the origin of the median postparietal or the parietal lappet present in *Diadectes* and other reptilomorphs (Berman *et al.* 1992). Jarvik (1967), Gauthier *et al.* (1988) and Berman *et al.* (1992) regard the parietal lappet of *Diadectes* as the intertemporal

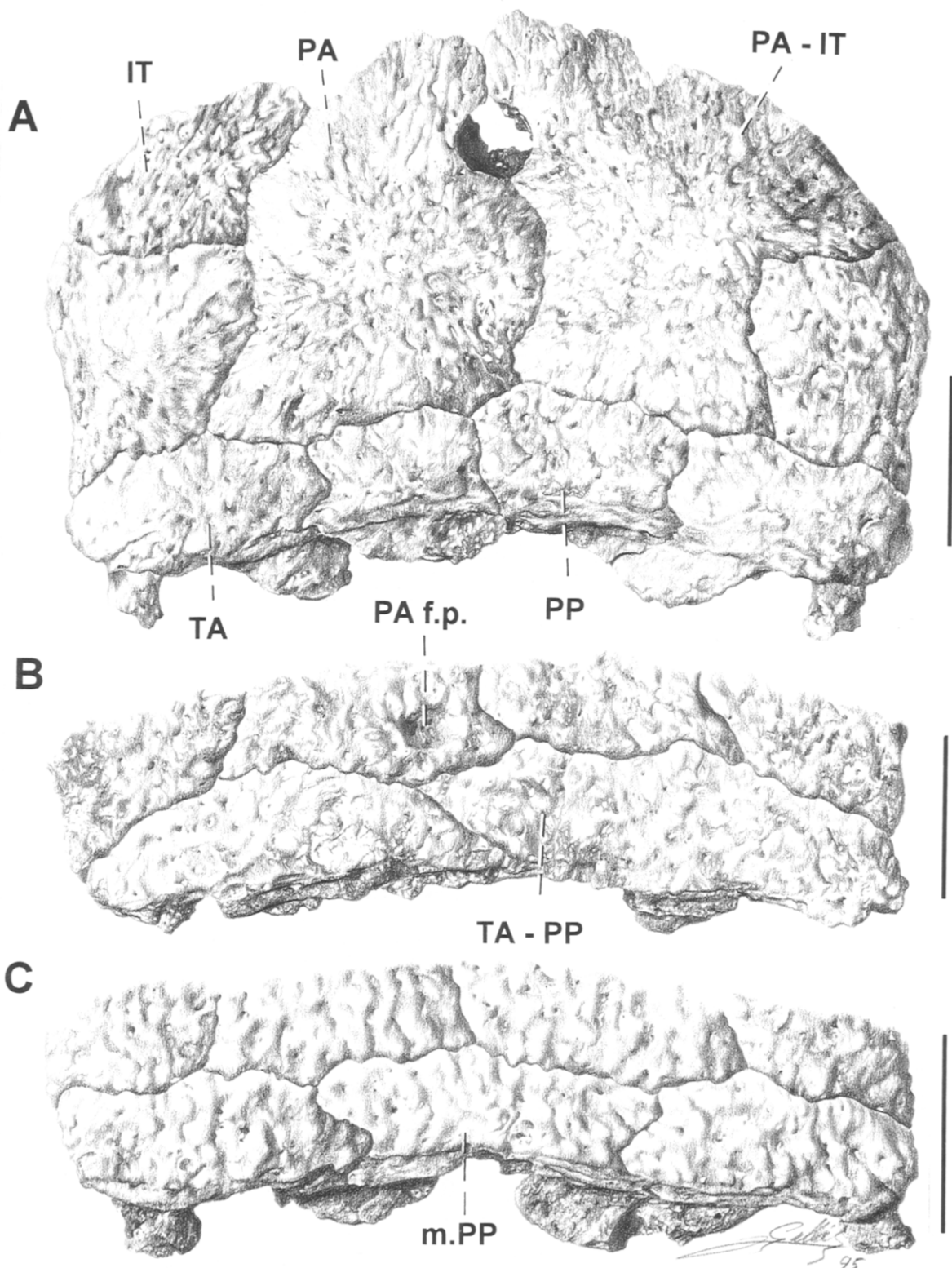


Figure 2 - *Discosauriscus austriacus* (MAKOWSKY, 1876), **A**, KO 179, skull table in dorsal view (slightly reconstructed) ; **B**, D 43, tabulo-postparietals in dorsal view ; **C**, K 80, median postparietal in dorsal view (cf. Klembara 1993, fig. 16B). Scale bar = 5 mm. **IT**, intertemporal ; **PA f.p.**, parietal foraminiate pit ; **PA-IT**, parieto-intertemporal ; **PP**, postparietal ; **TA**, tabular ; **TA-PP**, tabulo-postparietal ; **mPP**, median postparietal. *Discosauriscus austriacus* (MAKOWSKY, 1876), **A**, KO 179, toit crânien en vue dorsale (légèrement reconstitué) ; **B**, D 43, tabulo-postpariétaux en vue dorsale ; **C**, K 80, postpariétal médian en vue dorsale (cf. Klembara 1993, fig. 16B). Échelle = 5 mm.

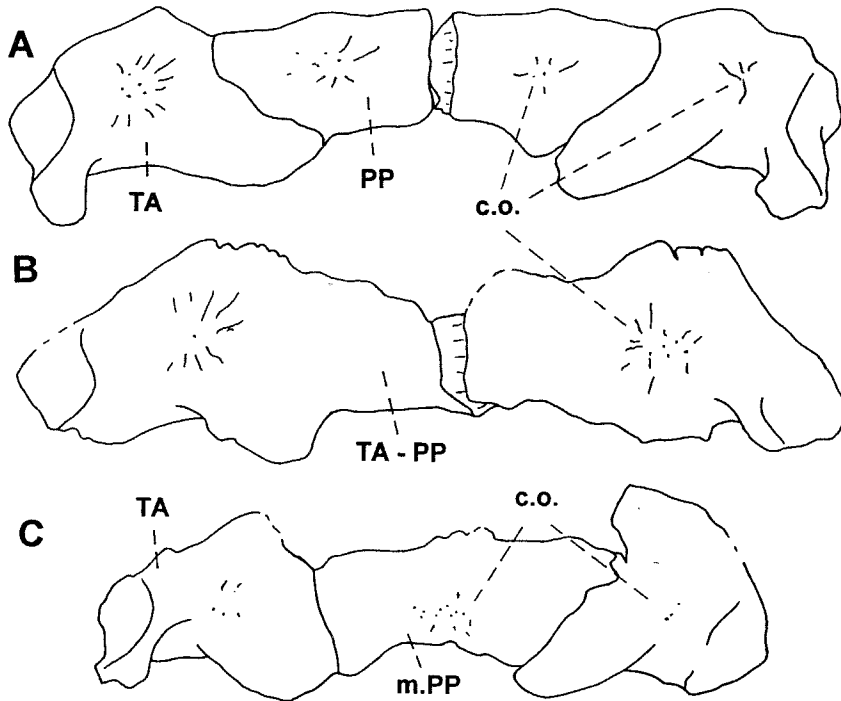


Figure 3 - *Discosauriscus austriacus* (MAKOWSKY, 1876), A, K 6, tabulars and postparietals in ventral view ; B, D 43, tabulo-postparietals in ventral view (cf. Klembara 1993, fig. 16A) ; C, K 80, tabulars and median postparietal in ventral view. Notice the position of growth centers. Scale bar = 5 mm. PP, postparietal; TA, tabular ; TA-PP, tabulo-postparietal ; c.o., center of growth ; mPP, median postparietal. *Discosauriscus austriacus* (MAKOWSKY, 1876), A, K 6, tabulaires et postpariétaux en vue ventrale ; B, D 43, tabulo-postpariétal en vue ventrale (cf. Klembara 1993, fig. 16A) ; C, K 80, tabulaires et postpariétal médian en vue ventrale. Remarquez la position des centres d'ossification.

fused with the parietal. If so, it is necessary to use the name parieto-intertemporal in these forms, because the parieto-temporal of KO 179 is not homologous with the parietal of the left side of the same specimen. The intertemporal is probably incorporated to the parietal of the earliest known amniote *Westlothiana* (Smithson *et al.* 1994).

CONCLUSIONS

Based on the data presented above, I conclude that it is necessary to recognize phylogenetic fusion (supported by evidence of ontogenetic fusion) of two or more original components by the formation of exocranial bones in different phylogenetic lineages of vertebrates. As concluded by Jarvik (1948, 1972) and Patterson (1977), this hypothesis is preferable to one supporting a phylogenetic loss of one bone and the "invasion" or "capture" of its territory by adjacent bone(s) in derived forms. It is necessary to revise and establish the homologies of the skull roofing bones in different early tetrapod groups. From this point of view, it is logical to name a tabular-squamosal bone in the skull roof of adelospondyls by Andrew & Carroll (1991) ; it would be difficult to presume that only

one bone "captured" the large territory of the other(s) bone(s) of this skull region (cf. similar conditions in microsaur ; Milner 1993 : 10). The same is true for all compound bones presented above in *Discosauriscus*.

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