

chemistry, however, is that molecular reconstructions should be the beginning of an experimental research programme and not the final goal of an evolutionary analysis. When reconstructed ancient biomolecules are made and studied in the laboratory, they can provide information about ancestral environments<sup>14-16</sup>, help correlate *in vitro* biochemical behaviour with *in vivo* physiological function<sup>2</sup>, and uncover mechanisms by which organisms generate new biomolecular function.

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## A large French Cretaceous bird

SIR — We report the discovery of a fragment of the synsacrum of a large bird in the continental Upper Cretaceous of south-eastern France. It is the first bird to be reported from the Upper Cretaceous of southern France. Although no precise identification is possible, it was apparently a bird with an advanced synsacrum, possibly as large as a modern cassowary or ostrich. This discovery suggests that some of the abundant Late Cretaceous fossil eggs from southern France usually assigned to dinosaurs may in fact be bird eggs.

The 65-mm-long synsacrum fragment was discovered by two of us (P. M. and A. M. S.) in a Late Cretaceous (probably

Early Maastrichtian<sup>1</sup>) vertebrate locality in the Fox-Amphoux basin (Var department, Provence). Its fairly well preserved ventral part allows a relatively accurate placement by comparison with synsacra of modern birds. It is broadest anteriorly, with three laterally and dorsally directed transverse processes, which originally contacted the ilium, on the right side (only two are preserved on the left side). In this region, the dorsal part has a system of complicated, poorly preserved, bony laminae which correspond to the modified neurapophyses occupying the roof-shaped space formed by the dorsally fused ilia in modern birds. More posteriorly, the ventral part of the specimen becomes narrower, forming a parallel-sided rod with a shallow median furrow. Dorsally, this part shows the poorly preserved bases of vertically directed processes. Comparison with modern birds shows that this fragment corresponds to the posterior synsacral lumbar vertebrae and anterior sacral vertebrae<sup>2</sup>.

The attribution to a bird is based on the complete fusion of the vertebral elements, which is exactly comparable to the condition in modern birds. In theropod dinosaurs with avian characters, such as ornithomimosaur, oviraptorosaurs, troodontids and dromaeosaurids, vertebral fusion in the sacrum is never so pronounced and the limits between the individual vertebrae are still visible. Many primitive Cretaceous birds<sup>3</sup> also display incomplete fusion of the synsacral elements. Although neither a definitive identification nor an attribution to one of the main groups of Cretaceous birds recently recognized (enantiornithines, ornithurines and “transitional shorebirds”)<sup>4</sup> is possible, our specimen apparently indicates a form with an advanced

synsacrum resembling that of modern birds. It is the first bird skeletal element to be described from the Upper Cretaceous of France and one of a very few birds known from the European Upper Cretaceous. Bones from the Maastrichtian of Transylvania once referred to birds are now considered as those of small theropods. Bird fragments from the Chalk of Scandinavia do not include sacral elements.

Although it is difficult to estimate the total length of the synsacrum, because the proportions of this element vary quite widely among birds, the great breadth (maximum breadth, as preserved, 40 mm) and robustness of the specimen are remarkable. The sacrum of the Fox-Amphoux bird was more robust than that of *Hesperornis regalis* (hitherto the largest known Cretaceous bird, with a total length of 1.80 m), and differently built. Comparisons with recent birds suggest that the synsacrum from Fox-Amphoux was in the size range of the cassowary or even the ostrich (although there are no special morphological resemblances with living ratites). The specimen is also somewhat reminiscent of the giant Eocene flightless bird *Diatryma*. Although the proportions of the complete skeleton cannot be reconstructed, there is no doubt that it was indeed large, especially by Cretaceous standards. Whether it was a flying or flightless form cannot be determined.

The discovery of a large bird in the Upper Cretaceous of Provence has implications for the interpretation of the abundant fossil eggs from the Upper Cretaceous of southern France, which have usually been attributed to dinosaurs<sup>5</sup>. No embryo or neonatal remains have yet been found in association with these eggs, and the occurrence of a large bird in the Upper Cretaceous of Provence suggests that some of them may in fact be bird eggs. This in turn implies that stratigraphical or palaeobiological speculations based on the assumption that all those eggs are dinosaur eggs should be treated with caution.

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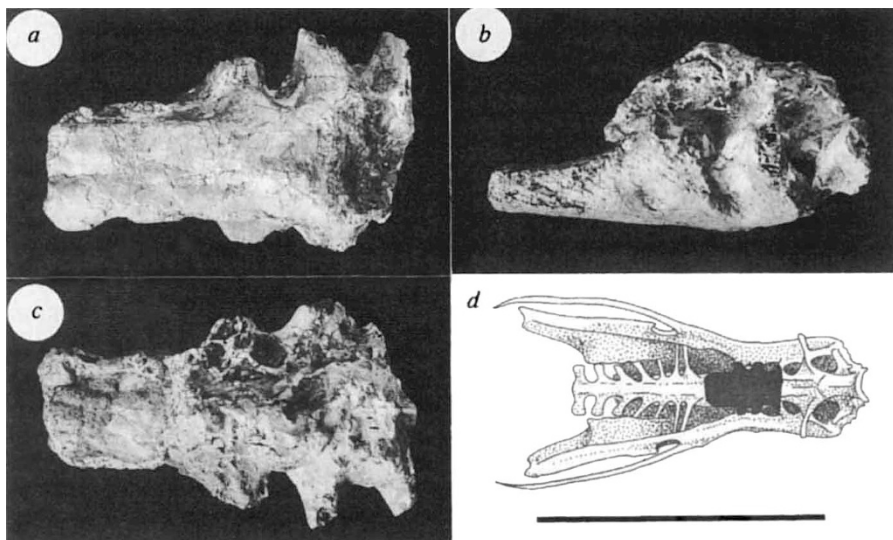
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Synsacrum fragment of a bird from the Upper Cretaceous of Fox-Amphoux (Var, France; deposited at the Musée des Dinosaures, Espéraza) in ventral (a), dorsal (b) and right lateral (c) views. Scale bar, 5 cm. Photos by C. Abrial. The sketch (d) shows the approximate position of the fragment in a bird pelvis, seen in ventral view (based on a flamingo pelvis, although no special relationships with flamingoes are implied). Drawing by G. Le Roux.

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