Rivista Italiana di Paleontologia e Stratigrafia	volume 102	numero 1	pagine 131-134	Aprile 1996

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AN EXCEPTIONAL REPTILE FIND IN THE NORIAN (LATE TRIASSIC) LAGERSTÄTTE OF ENDENNA (ZOGNO, BERGAMO, ITALY)

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Key-words: Reptilia, Norian (Late Triassic), Calcare di Zorzino, Lombardy (Northern Italy), new find.

Riassunto. Durante un sopralluogo nella località di Endenna (Zogno, BG) il 5.10.95 è stato rinvenuto un frammento di un grande rettile parzialmente danneggiato da scavatori abusivi. Dopo il salvataggio del blocco già isolato, si è provveduto alla ricerca e al recupero della rimanente parte dell'esemplare. Durante questi lavori sono anche stati sorpresi alcuni scavatori abusivi che sono stati segnalati alla competente Soprintendenza. Il rettile si presenta completamente inglobato in matrice calcarea molto tenace e si prefigura parzialmente arrotolato e con il cranio disarticolato rispetto al resto del corpo. La lunghezza totale supera i 4 m e lo stato di conservazione è da ritenersi ottimo. Sulla base di osservazioni preliminari si può ipotizzare la sua appartenenza all'ordine Thalattosauria. Si tratterebbe quindi del più grande rettile acquatico triassico, con l'esclusione degli ittiosauri, finora conosciuto.

Abstract. During a survey at the fossiliferous site of Endenna (Zogno-Bergamo) of Norian age, a huge reptile has been found at October the 5th, 1995. The recovery of the whole specimen took place at the beginning of November. Four main blocks, plus minor fragments, are now in the laboratory of the Department of Earth Sciences of the Milano University, waiting for the long preparation. The specimen is somewhat more than four meters long, the head being disarticulated in front of the body. A preliminary survey suggests the reptile may be ascribed to Thalattosauria, thus, apart from the ichthyosaurids, it would be the largest marine reptile of the Triassic.

The find.

The fossil-site of Endenna (Zogno, Bergamo, Italy) is one of the most important sites in the Calcare di Zorzino (Zorzino Limestone) (Tintori et al., 1985). With the permit of the Soprintendenza Archeologica della Lombardia and under the direction of the senior author, field-works were carried out from 1978 until 1983, when works were stopped for logistic causes and started in the nearby Zogno2 locality. Nonetheless, regular surveys are necessary because private collectors frequently damage the site, anything but exhausted. A couple of them have been catched during the recent works and reported to the competent authority.

Hundreds of fishes have been collected during six years of digging (Beltan & Tintori, 1980; Tintori, 1980, 1981, 1983, 1990, 1991, 1992, 1995; Tintori & Renesto, 1983; Tintori & Sassi, 1992), together with some reptiles (Padian, 1981; Pinna, 1979, 1980, 1984; Pinna & Nosotti, 1989; Renesto 1984, 1992, 1993, 1994a, b, c, 1995a, b; Renesto & Tintori, 1995) and several, mostly undescribed, invertebrates (Basso & Tintori, 1994).

On the last 5th of October, the senior author was accompanying Dr. W. Bausch (Erlangen, Germany) to a survey for geochemical sampling in Endenna. He found a block, measuring about 80x40 cm (block n.3) which showed remains of a very large organism, possibly a reptile. Coming from level 11 (Tintori et al., 1985), the block had been removed and damaged by unauthorized diggers. In this case, splitting was difficult because the big fossil has disturbed the regular lamination and has caused a locally stronger cementation. The relative position between the block and the rest of the layer was difficult to state, but the possibilities that at least part of the fossil was still in place were good. The problem was that the find was close to the end of the fossil-level outcrop, so we wondered how much of the fossil had been already destroyed by natural erosion.

The block was taken to Milano only a few day after and, by the end of October, we organized the recover of the rest of the fossil. It took two days of work (the 30th of October and the 2nd of November) for six people, but we had the greatest expected success: the remain of the reptile was still in place and could be completely removed.

Closely observing the front of layer 11, we could see that the reptile was in its lower part. The upper part was then removed; the underlying thin, shaly level made the rest of the fossiliferous level easy to take off. Taking advantage of a lateral small karstic canal (KC in Fig. 1) and natural fractures the caudal region (Fig. 2)

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has been evidenced on the upper surface of a slab (Fig.1; block 4) measuring about 140x105 cm. The rest of the fossil was more problematic to recover: the fracture between blocks 2 (60x50 cm) and 1 (75x30 cm) was irregular, leaving a couple of small fragments in between. On the whole, the reptile has suffered very little damage. The total weight of the blocks is about 250 kg; they have been trasported for about 1 km on hand-barrow up to the car.

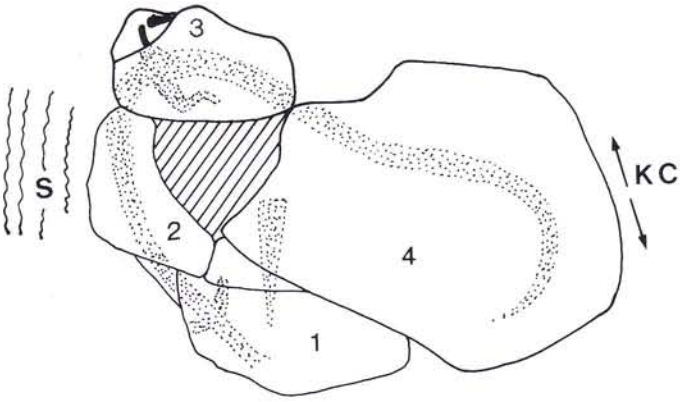

Fig. 1 - Schematic draw of the four blocks with the probable reptile outline (dotted area, in black the already exposed posterior leg) as seen from above. KC: karstic canal; S: slumping like deformation of the underlying laminae beside the specimen belly; striped area: empty region.

We expect the preparation will take a very long time: on the lower side, apparently the easiest, at least 18 months are necessary to expose the bones. However, it will be convenient to expose the fossil on both sides, at least in important parts, because it is fortunately very slightly compressed; even the head is tridimensionally preserved. 3D conservation is rarely found in our Norian localities and only regards parts of large specimens with strong structures (the skull of *Mystriosuchus* and the mouth region of large *Sargodon tomicus*). Normally, fossils are totally flattened and bones are more or less broken by lithostatic pressure.

Taphonomic and systematic remarks.

The impact of the reptile body on the bottom compressed the underlying laminae, inducing also a unidirectional slumping-like deformation for at least 1 m from the body itself (S in Fig. 1); this fact, together with the absence of further compression of the skeleton, suggests that diagenesis in this level has been remarkably early. Laminae in fact, show folds which keep their individuality. An accurate sedimentological-geochemical study on those laminae is trying to understand the first diagenetic stages in an anoxic environment with predominant carbonatic sedimentation.

Shape and dimension of the skeleton can be guessed trough the sediment covering the fossil. A part of the posterior leg (knee articulation) has been already prepared, to help in a preliminary classification. The observation of the fossil suggests that the reptile has long trunk and tail, relatively short legs and considerably long skull. Its total length should be more than 4 m. The body, lying on its belly, forms an almost complete circle (Fig. 1). All these features indicate the skeleton does not belong to an ichthyosaur; in fact, femur, tibia and fibula, showing sharp epiphyses and narrow diaphyses, are very different from those of Ichtyosaurs. On the basis of the same morphologic features we can exclude the fossil belongs to the nothosaurs, which have shorter tail, longer neck and smaller skull. Leaving apart the ichthyosaurs, to nothosaurs belonged the largest known acquatic reptiles in the Triassic, before this find. A specimen of *Paranothosaurus amsleri* from the Ladinian of Monte San Giorgio (Canton Ticino, Switzerland) reaches 3.80 m and it was the largest one, as far as we know.

Triassic phytosaurs seem to show more similarities with the new find. They are crocodile- like archosaurs with nostrils back near the eyes. Phytosaur remains are known from Upper Triassic in Germany, in USA and in India and fragments are found also in several sites of the Middle and Far East. Phytosaurs are thought to have dwelled in continental environments, such as lakes and alluvial plains, and to have very rarely visited marine waters. This is clearly in contrast with the fossilization environment of the Calcare di Zorzino, which is an intraplatform basin with only small islands nearby (Jadoul et al., 1994; Renesto & Tintori, 1995; Tintori, 1995). Nonetheless, an isolated skull of a phytosaur had been already found in Endenna, but it is probably a fragment of a floating skeleton coming from dry land (Renesto, 1995b). The new specimen cannot have been transported: its skeleton is complete and perfectly articulated, apart from the skull. Moreover, though the relative dimensions of the skull are comparable to those of phytosaurs, other features have different proportions: tail, for example, is too long. Only a last group of reptiles can be compared with the new, large specimen: Thalattosaurs. These are possibly archosauromorph reptiles characterized by relatively short legs and long, laterally compressed tail.

Thalattosaur remains are known from the Middle Triassic of the Formazione di Besano (Grenzbitumenzone for the Swiss authors) and of California and from the Upper Triassic of British Columbia. Also Endenna have yielded two specimens of *Endennasaurus* (Renesto, 1984, 1992). Thalattosaurs lived in strictly marine environments (fossils are often associated with ichtyosaurs and ammonites) and they likely had a semi-durophagous diet. Proportions of the new reptile are well comparable

Fig. 2 - The slab (block 4 in fig. 1) with the tail. Scale-bar: 15 cm.

to those of thalattosaurs and their life environment is in agreement with the paleoenvironmental reconstruction of the Calcare di Zorzino.

In conclusion, for the classification of the new reptile specimen, three hypotheses can be put forward, with decreasing likelihood: it is a new genus of thalattosaur, it is a phytosaur or it is a totally new organism. In any case, this new find will through new light on the life environment of the Zorzino fauna: before this, no very large reptile had been found. This fact was explained with the presence of geographical and ecological barriers for both marine and terrestrial organisms, which favoured the rising of an endemic reptilian fauna made of mainly small species. Now we must reconsider that, or suppose that those infraplatform basins were so rich in life that also large organisms could develop and be sustained.

Acknowledgements.

Thank are due to the Soprintendenza Archeologica della Lombardia which gave us the special permission to recover the specimen. The picture is by G.Chiodi. The hand-barrow shafts were made of the mast of AT brother-in-law old wind-surf: to Carlo our sincere thanks.

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Received January 23, 1996; accepted February 7, 1996