A NEW SPECIMEN OF NOTHOSAURUS FROM THE LATEST ANISIAN
(MIDDLE TRIASSIC) BESANO FORMATION (GRENZBITUMENZONE) OF ITALY

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Key words: Nothosaurus (Reptilia Sauropterygia), Besano Formation, Late Anisian, Middle Triassic, Monte San Giorgio, paleobiology, sympatric species, niche partitioning.

Abstract. A nearly complete but disarticulated skeleton of a small sized nothosaur is described. The specimen was collected in 2003 from an outcrop of the Besano Formation (Grenzbitumenzone of Swiss authors) of Late Anisian (Middle Triassic) age, in the Monte San Giorgio Area, northern Italy. The osteology of the postcranial skeleton supports the assignment to the genus Nothosaurus, and also excludes its belonging to Nothosaurus giganteus/Panorosaurus amderi already known from coeval localities of the Besano Formation in the Swiss part of the Monte San Giorgio area. Despite the lack of most of the skull, which contains diagnostic characters at the species level for Nothosaurus, the few preserved cranial elements suggest similarities with N. juvenlis which skull, and only known part, is also of comparable size. This specimen is particularly significant because it improves the knowledge of the osteology of N. juvenlis and because the second Nothosaurus species, smaller than N. giganteus/P. amderi, suggests coexistence of sympatric species characterized by size and, probably, trophic differentiation within the genus Nothosaurus in the Monte San Giorgio area as occurred in the coeval Germanic Basin.

Riassunto. Viene descritto lo scheletro quasi completo, ma totalmente disarticolato e privo di quasi tutto il cranio, di un piccolo nothosaurusiforme proveniente dalla Formazione di Besano (Grenzbitumenzone) risalente all’Anisico sommitale (Triassico Medio). I caratteri osteologici dello scheletro postcraniale consentono l’attribuzione al genere Nothosaurus ed escludono nel contempo la sua appartenenza alla specie Nothosaurus giganteus/Panorosaurus amderi, già nota da altri ritrovamenti svizzeri della Grenzbitumenzone. Purtroppo l’esemplare è quasi completamente privo del cranio, che contiene la maggior parte dei caratteri diagnostici a livello specifico per Nothosaurus, tuttavia le parti conservate permettono di ipotizzare la possibile appartenenza dell’esemplare a N. juvenlis. Il ritrovamento è particolarmente significativo perché se da una parte permettebbe di aumentare considerevolmente le conoscenze sull’osteologia di N. juvenlis, in ogni caso testimonia la presenza di una seconda specie di Nothosaurus nella Formazione di Besano di dimensioni minori rispetto a Nothosaurus giganteus/Panorosaurus amderi. Questo suggerisce un scenario di comprensione di specie simpatriche dello stesso genere nell’area del Monte San Giorgio, caratterizzate da dimensioni differenti, che quindi si cibavano di prede diverse con relativa suddivisione di nicchie trofiche, come è stato proposto per i notosauri coevi del Bacino Germanico.

Introduction

The rich vertebrate fauna of Besano-Monte San Giorgio (Lombardy, Italy and Canton Ticino, Switzerland) is among the most important in the world for the Middle Triassic even after the recent discoveries in China. The site represents an invaluable tool for comparisons among these faunas for a more complete delineation of the biogeography and evolution of Middle Triassic fishes and reptiles.

The first finds were reported by Curioni in 1847, and since then, vertebrates from the Besano-Monte San Giorgio have been studied extensively, with abundant material collected during paleontological excavations and mining between the end of 19th and the first half of the 20th centuries. Fossils have been collected from different formations (Fig. 1), belonging to four horizons (Zangerl 1935) which age spans from the upper Anisian Besano Formation to the upper Ladinian Kalkschieferzone (Furrer 1998). The marine reptiles comprise ichthyosaurs, thalattosaurus, sauropterygians, while pterosaurs were semi-aquatic (Tanystrobus) or terrestrial (Macrocnemus) and large rauisuchians (Ticinosuchus) lived on land (Peyer 1937; Krebs 1963; Kuhn-Schnyder 1962). Eusauropterygians, especially pachypleurosaurs, are among the most abundant reptiles, with two genera and four species so far described (Carroll & Gas-kill 1985; Rieppel 1989; Sander 1989; Tschanz 1989).
In the Swiss localities of the Besano Formation both large (*Notosaurus giganteus* = *Paranotosaurus amstel*) and small notosauroids (*Lariosaurus buzi* = *Silvestrosaurus*) were also found along with neusticosaur *Serpianosaurus* (Peyer 1939; Kuhn-Schnyder 1990; Tschanz 1989; Rieppel 1989; Sander 1989), while only *Serpianosaurus* has so far collected from the Italian localities of Besano.

The present paper describes the first *Notosaurus* specimen collected in the Italian part of the Monte San Giorgio Area. The specimen is nearly complete but disarticulated. It is housed in the paleontological collection of the Museo Civico di Storia Naturale di Milano (Italy) with the catalogue number BES SC 1736. The specimen was collected in the Sasso Caldo Quarry (Fig. 1), an outcrop of the unit previously named Scisti Ittioliti di Besano on the Italian side and “Grenzbitumenzone” (Frauenfelder 1916) on the Swiss side. The Besano Formation includes the Anisian-Ladinian boundary in its uppermost part (Brack et al. 2005). The described specimen was collected below the tuffitic layers and hence is of late Anisian age.

BES SC 1736 shows unequivocal characters that allow its assignment to the genus *Notosaurus*, and shows also some characters suggesting it could belong to the species *N. juvenlis* Edinger, 1921.

**Systematic Paleontology**

**Sauropterygia** Owen, 1860

**Eosauropterygia** Rieppel, 1994a

**Eusauropterygia** Tschanz, 1989

**Notosauridae** Baur, 1889

**Notosaurinae** Nopcsa, 1923

**Notosaurus** Münster, 1834

Type species: *Notosaurus mnachilis* Münster, 1834, Upper Muschelkalk, Middle Triassic of Germany.

**Notosaurus cf. N. juvenlis** Edinger, 1921

Figs 2-8, Pl. 1-4

1921 *Notosaurus juvenlis* Edinger fig.4.
1965 *Notosaurus juvenlis* Edinger - Haas, p. 37 pl. 12
1970 *Notosaurus juvenlis* Edinger - Schultze, p. 225 fig. 13
1994 *Notosaurus juvenlis* Edinger - Rieppel, p. 735 fig. 1.
Fig. 2 - A-D, BES SC 1736, *Notosaurus* cf. *N. juvenilis*. Photographs (left) and sketches (right) of the four small slabs showing the position of most relevant bones. Abbreviations are: c) carpal bone (unidentified), cl) clavicle, co) coracoid, cv) cervical vertebrae (both isolated centra and neural arches), h) humerus, mc) metacarpals, na) neural arches, r) ribs, ra) radius, rp) retroarticular process of the lower jaw, u) ulna. Scale bars equal 50 mm.
Fig. 3 - BES SC 1736, Nothosaur us cf. N. juventilis. A) Photographs and B) sketch of the larger, composite slab showing the position of most relevant bones. Abbreviations are: a) astragalus, ca) calcaneum, cdv) caudal vertebrae, cr) caudal ribs, f) femur, il) ilium, is) ischium, mt) metatarsals, p) pubis, ph) phalanges, sr) sacral ribs, sv) sacral vertebrae, ti) tibia, 4dt) fourth distal tarsal. Scale bar equals 50 mm.
Holotype: K.8698-1 Palaeontological and Geological Institute and Museum, University of Heidelberg, Germany.

Material: BES SC 1736 (Fig. 2-3) Museo Civico di Storia Naturale di Milán (Milan, Italy). Collected from the outcrop of Sassu Caldo (Fig. 1), near Besano (Lombardy, northern Italy); Formazione di Besano, latest Anisian (Middle Triassic).

Description

General remarks. BES SC 1736 is a nearly complete but almost completely disarticulated skeleton of a mid-sized eusauropterygian, lacking most of the skull, lower jaw and right fore limb. Bone measures are reported in Tab. 1. The specimen is preserved on several stone slabs (Figs 2-3), some of which do not match to each other because further slabs with missing elements were lost or destroyed during field work. By joining the matching portions of each slab, it has been possible to obtain six main slabs. In the first slab (Fig. 2A) are preserved a few cervical vertebrae, the left paroccipital process and the caudalmost portion of the lower jaws with both the right and left retroarticular processes and the left articular area for the quadrates. On the second, third and fourth slab (Figs. 2B-D) are preserved dorsal vertebrae and ribs, a few elements of the gastralia a partial clavicle, two coracoids, one humerus, left and right ulnae (on different slabs) one radius and elements of the carpals, metacarpus and few phalanges, presumably of the manus. The sixth slab (Fig. 3) is composed of smaller pieces that match together. This slabs preserves the last dorsal vertebrae and ribs; many gastralia; sacral, some caudal vertebrae and ribs, most elements of the pelvic girdle, two femora; one tibia and disarticulated elements of the tarsus, metatarsus and pes.

Skull. Only part of the occipital region is preserved (Fig. 4, Pl. 1A), the suspensorium process is strongly inclined caudolaterally, suggesting a distinct caudal displacement of the lower jaw articulation with respect to the (unpreserved) occipital condyle. The caudal portion of the left paroccipital process is very well preserved and shows how the pterygoid forms deep flanges running along the whole quadratojugal ramus of the pterygoid, which is typical for Notosaurus (Rieppel 1984b; Rieppel & Wild 1996). The mandibular condyle of the quadrate is slightly compressed diagenetically, but is still articulated with the lower jaw.

Lower jaw. Part of the left articular area and both left and right retroarticular processes are well preserved (Fig. 4, Pl. 1A). The articular area for the quadrate is saddle shaped, with raised cranial and caudal margins. The retroarticular process is elongate and stout.

Vertebral column. Nearly all the centra are disassociated from their neural spines. The centra (Fig. 5 A, E, G, H, Pl. 1A) are slightly constricted assuming a faint hourglass shape, their ventral surfaces bear a small, slight keel, and their articular surfaces are paticoelous. In dorsal view, the disarticulated centra show cross-shaped facets for articulation of the pedicles of the neural arches as is typical for Eusauropterygia. The neural arches bear large, swollen pre- and postzygapophyses with nearly horizontal articular surfaces (Fig. 5 B-D; Pl. 1 B-D). A deep zygantrum is present between the postzygapophyses, divided by a septum and the zygosphene is bifurcated anteriorly (Fig. 5C-D; Pl. 1B). The transverse processes project laterally only slightly beyond

Fig. 4 - BES SC 1736, Notosaurus cf. N. juvenilis. A) sketch of preserved elements of the skull (light grey) and of the lower jaw (dark grey), along with disarticulated cervical centra (outlined); B) detailed drawing of the right articular area; C) outline of a generalized nothosaur skull (light grey) and lower jaw (dark grey), highlighting (rectangle) the portion of the skull detailed in (B). Scale bar equals 20 mm. Abbreviations are: ar) articular; par) prearticular; pt) pterygoid; q) quadrate; sa) surangular.
the zygapophyses, are strong with a wide base, reaching ventrally to the neurocentral suture (Fig. 5C; Pl. 1D). The transverse processes are separated from the postzygapophyses by a distinct notch. The neural spines of the dorsal vertebrae are subrectangular in shape, their axis slightly slanting caudally with no distal expansion as is typical for nothosaurs (Rieppel & Hagdorn 1997), approximately one and an half higher than long; the height of the neural spines does not vary much along the vertebral series, although their height decreasing gradually, starting from the mid-caudal region.

Ribs and gastralia. The cervical ribs (Pl. 2 B-C) are diacephalous, with broad pedicels, a short shaft and a small free anterior process. The dorsal ribs (Pl. 2A) are holocephalous, with a flat or slightly convex articular area, evenly curved and expanded distally. The sacral ribs (Pl. 2 F-H) are stout and bear expanded heads at both ends. The caudal ribs (Pl. 2D) from the cranial region of the tail show a broad articular surface, a straight shaft tapering distally, ending in a broad, but not expanded, distal end. Several disarticulated gastralia are present, seemingly composed by three elements. The medial elements of the gastralia have an inverted “V” shape and bear a short but distinct cranial process (Pl. 2E).

Shoulder girdle. The cranialateral portion of the left clavicle and both coracoids are preserved. The pre-
served fragment of the clavicle (Fig. 6A; Pl. 3A) shows an expanded horizontal blade which forms a pronounced cranialateral corner. The coracoids (Fig. 6B; Pl. 3B) are broad and flat, waisted bones with distinctly concave cranial and caudal margins and convex medial and lateral margins. Both coracoids are preserved at the borders of the slabs, so that their cranial and caudal margins are incompletely preserved, rendering impossible to check the shape and size of the preglenoid processes.

Pelvic girdle. The ilium is small, with a reduced iliac blade, which is separated from the acetabular area by a faint constriction (Fig. 7A-B; Pl. 3F-G). A small preacetabular process and a spina preacetabuli are both present. The only preserved pubis is partially overlapped by a dorsal rib and part of its caudal margin is broken (Fig. 7D; Pl. 3F); it is a broad, plate-like bone, with concave cranial and caudal margins and convex lateral (dorsal) and medial (ventral) margins. The dorsal margin is expanded and thickened as it participates in the acetabulum; despite the presence of an overlapping rib, it can be noted that the medial margin shows a distinct embayment, similar to that figured by Peyer (1939, fig. 6) for Nothosaurus giganteus/Paramomo-
saurus ansleri. The obturator foramen is slit-like. The ischium (Fig. 7C; Pl. 3B) is a subtriangular, fan-shaped bone, with distinctly concave cranial and caudal margins and convex lateral and medial margins. The ischium is greatly expanded toward its medial margins. The pronounced concavity of the caudal margin of the pubis, and of the cranial margin of the ischium form a wide fenestra thyroidea.

Fore limb. Only the right humerus is partially preserved: it lacks most of the preaxial portion of the shaft, while both proximal and distal heads are more complete (Fig. 6C; Pl. 3C). It is flattened and curved (with a convex preaxial and a concave postaxial border, Rieppel 1994a; Rieppel & Wild 1996), with slightly convex proximal and distal heads. The ectepicondyle is reduced. A well preserved ulna is present close to the humerus. The ulna is flat and broader than the radius and both the proximal and the distal heads are expanded (Fig. 6D; Pl. 3C), the proximal head being approximately 20% wider than the distal head (Tab. 1). The radius (Fig. 6E; Tab. 1) is narrower than the ulna, and its proximal and distal heads are slightly expanded. The morphology of these two bones is nearly identical to those of the radius and ulna of a Nothosaurus specimen from Winterswijk (Bickelmann & Sander 2008). Carpal bones are scattered along the slab surface or missing. A discoidal, flat bone with a subcircular margin inter-

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![Diagram of bones](image)
ruptured by a small embayment is preserved close to the right coracoid, and can be identified as an intermedium. A series of associated metacarpals are preserved with the left coracoid and most of other bones of the forelimb (Pl. 4B). The metacarpals are elongate, narrow bones, with slightly expanded heads. A further element is present, it is much shorter and less expanded at its distal end: it could be the first metacarpal. A few dissociated phalanges lie close to the metacarpals; they are short and broad, some, probably the more distal ones, are nearly discoidal in shape. Due to disarticulation and lack of elements, no phalangeal formula can be given.

Hind limb. The femur (Fig. 7D; Pl. 3D) is approximately the same length as the humerus, but with a straight and very narrow shaft. It has expanded proximal and distal heads, the latter showing a slightly convex outline. A thick ridge running close to the cranial margin of the proximal head could represent the internal trochanter. The femurs show a very shallow intertrochanteric fossa. A isolated tibia (Fig. 7E) is partially preserved at the margin of the larger slab, lacking the proximal head. It shows a hourglass outline with a straight shaft axis and slightly convex distal margin. The fibulae are missing. Among the preserved tarsal bones (Pl. 4C) is an astragalus with a rounded outline and an embayment of its proximal margin, which is also thickened by a small ridge. This concavity indicates that the perforating artery passed proximal to the tarsus as for other nothosaurs and Simosaurus (Rieppel 1994a). A subcircular bone, slightly smaller than the astragalus, is identified as the calcaneum (Pl. 4C). A third, very small discoidal bone close to the astragalus may represent a disarticulated fourth distal tarsal (Pl. 4C). The metatarsals are elongate with narrow shafts and expanded heads; one of the identified metatarsals is rather stubby and reaches half the length of the others and is identified as the first metatarsal. The pedal phalanges are short and broad, like those of the manus, the more distal ones being discoidal in shape. As in the manus, no phalangeal formula can be given for the pes.

Stomach contents. Several small bones and bony fragments are present as scattered elements between the ribs and vertebrae on the larger slab (Pl. 4D), in the area corresponding to the abdominal region and can thus be considered as stomach contents with some confidence. Fish scales and ribs are present along with tiny vertebrae, possible limb bones and some claw-like elements (very probably ungual phalanges), of some reptile. Poor preservation prevents any reliable identification of these elements.

Discussion

The osteological correlates, especially the morphology of the vertebrae and bones of the shoulder girdle, allow assignment of BES SC 1736 without doubt to the Eusauropterygia as diagnosed by Rieppel (1994a). Three eusauropterygian taxa are so far known from the Besano Formation: the pachypleurosaurs Serpianosaurus mirgolensis (Rieppel, 1989), and the eusauropterygians Lariosaurus (Silvestrosaurus) buzzi (Tschanz, 1989) and Paranothosaurus amsteri (Peyer, 1939), considered by Rieppel & Wild (1996) as a junior synonym of Nothosaurus giganteus Münster, 1834. The presence of paticoolous centra and of at least four sacral ribs support its assignment to the Eusauropterygia Tschanz,
1989 as diagnosed by Rieppel (1994a). The morphology of the humerus of BES SC 1736 is like a scaled-up version of the humerus of *Lariosaurus (Silvestrosaurus) buzzii* (see Tschanz 1989: p. 167, fig. 7a-b) from the Grenzbitumenzone, rather than that of *Nothosaurus*. However, *Lariosaurus (Silvestrosaurus) buzzii*, apart for the much smaller absolute size, is different from BES SC 1736 for the presence of more developed and sharper cranial processes of the cervical vertebrae, for the distally expanded ulna and the relatively wider and less inclined suspensorium (Fig. 8G; Tschanz 1989: p. 160-1, figs. 2-3; for other characters see Tschanz 1989: p. 164, fig. 5g, p. 167, fig. 7f). In particular, the presence of a distally expanded ulna is considered diagnostic for the genus *Lariosaurus* (Rieppel, 1998). Thus BES SC 1736 can not belong to *Lariosaurus (Silvestrosaurus) buzzii*. 

Tab. 1 - Measurements (in mm) taken on the specimen.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of retroarticular process</td>
<td>20</td>
</tr>
<tr>
<td>Height of mid cervical rib</td>
<td>5.5</td>
</tr>
<tr>
<td>Length of disassociated cervical centra</td>
<td>15, 16, 17</td>
</tr>
<tr>
<td>Height of disassociated cervical neural arch</td>
<td>23</td>
</tr>
<tr>
<td>Maximum width of isolated cervical neural arch</td>
<td>24</td>
</tr>
<tr>
<td>Height of a disassociated dorsal neural arch and spine</td>
<td>34</td>
</tr>
<tr>
<td>Height of the neural spine of the same neural arch</td>
<td>15</td>
</tr>
<tr>
<td>Length of disassociated cervical centra</td>
<td>15, 14</td>
</tr>
<tr>
<td>Height of a distal caudal neural spine</td>
<td>12</td>
</tr>
<tr>
<td>Height of a distal caudal neural arch and spine</td>
<td>19</td>
</tr>
<tr>
<td>Length of the shaft of a dorsal rib</td>
<td>83</td>
</tr>
<tr>
<td>Length of the shaft of some disassociated sacral ribs</td>
<td>33, 31, 46</td>
</tr>
<tr>
<td>Length of disassociated caudal ribs</td>
<td>34.4, 32, 31, 25.5, 18, 14</td>
</tr>
<tr>
<td>Height of the coracoid</td>
<td>65</td>
</tr>
<tr>
<td>Pubis proximodistal (ventrodorsal) width</td>
<td>50</td>
</tr>
<tr>
<td>Ischium proximodistal (ventrodorsal) width</td>
<td>49.5, 48.5</td>
</tr>
<tr>
<td>Ilium height</td>
<td>21, 22</td>
</tr>
<tr>
<td>Humerus length</td>
<td>87</td>
</tr>
<tr>
<td>Humerus proximal width</td>
<td>24</td>
</tr>
<tr>
<td>Humerus distal width</td>
<td>28</td>
</tr>
<tr>
<td>Radius length</td>
<td>41.3</td>
</tr>
<tr>
<td>Radius proximal width</td>
<td>12</td>
</tr>
<tr>
<td>Ulna length</td>
<td>43.6</td>
</tr>
<tr>
<td>Ulna proximal width</td>
<td>20.5</td>
</tr>
<tr>
<td>Ulna distal width</td>
<td>16</td>
</tr>
<tr>
<td>Maximum diameter of dissociated intermedium</td>
<td>13.5</td>
</tr>
<tr>
<td>Length of preserved metacarpals</td>
<td>22, 20.5, 19.3, 13</td>
</tr>
<tr>
<td>Femur length</td>
<td>87, 86</td>
</tr>
<tr>
<td>Femur proximal width</td>
<td>20.7, 23</td>
</tr>
<tr>
<td>Femur minimum width</td>
<td>5, -</td>
</tr>
<tr>
<td>Femur distal width</td>
<td>20, 18</td>
</tr>
<tr>
<td>Tibia length</td>
<td>42</td>
</tr>
<tr>
<td>Tibia proximal width</td>
<td>13.5</td>
</tr>
<tr>
<td>Tibia distal width</td>
<td>14</td>
</tr>
<tr>
<td>Length of preserved metatarsals of ?left pes</td>
<td>26.6, 29, 25, 21.5, 12</td>
</tr>
<tr>
<td>Length of preserved metatarsals of ?right pes</td>
<td>27, 28, 24, 22, 13.5</td>
</tr>
<tr>
<td>Maximum diameters of the astragali</td>
<td>14, 15.3</td>
</tr>
<tr>
<td>Maximum diameters of the calcanei</td>
<td>11, 12.3</td>
</tr>
</tbody>
</table>
Several characters support instead the attribution of BES SC 1736 to the genus Notbosaurus; transverse processes of the dorsal vertebrae extending along the entire height of the pedicels (Peyer 1939; Rieppel & Wild 1996); zygantrum divided by a vertical septum and zygosphene bifurcated (Rieppel & Wild 1996); dorsal ribs not pachyostotic and distinctly expanded at their distal ends; presence of three sacral ribs with expanded distal ends (the fourth tapers distally); pubis notched at its ventral margin and with slit-like obturator foramen; ilium retaining a preacetabular process, femur with very shallow intertrochanteric fossa.

The assignment of BES SC 1736 to any known species of Notbosaurus is more difficult since most diagnostic characters at the species level concern the skull and very few relate to the postcranial skeleton. Apart from absolute size, the neural spines of BES SC 1736 are proportionally higher than in Notbosaurus giganteus/Paramothosaurus amleri but lower than in N. mirabilis (Fig. 8A–C), being proportionally an intermediate between N. giganteus and N. mirabilis, suggesting that BES SC 1736 does not belong to these species. The lower jaw joint of BES SC 1736 is caudally displaced with respect to the occiput, a character which has been considered diagnostic for Notbosaurus juvenilis Edinger, 1921 (Rieppel 1994b; Rieppel & Wild 1996). N. juvenilis is a small species of notosaur from the Upper Muschelkalk of Germany (Rieppel 1994b) which is coeval with the Besano Formation. In the Germanic Basin N. juvenilis apparently shared the same environment with the large sized N. giganteus and the intermediate sized N. mirabilis (Rieppel & Wild 1996). Unfortunately the lack of most of the skull hinders further analysis, so attribution of BES SC 1736 to N. juvenilis should be considered tentative, and thus classified as Notbosaurus cf. N. juvenilis. N. juvenilis is so far known only by an isolated skull from the Middle Triassic of Germany (Rieppel 1994b), and its ontogenetic status remains controversial (Albers & Rieppel 2003): thus BES SC 1736, if correctly attributed to this species, may improve knowledge of the anatomy and development of this species.

The finding of BES SC 1736 is also of significance for palaeoecological reasons, because it testifies to the presence of sympatric species of Notbosaurus in the Besano Formation, which probably avoided competition by exploiting different niches. Rieppel (1994b) and Rieppel & Wild (1996), have already discussed the
coexistence of three _Nothosaurus_ species of different absolute size ( _N. juvenilis_, _N. mirabilis_ and _N. gigan-
teus_) in the Triassic Upper Muschelkalk of Germany; suggesting a scenario of niche partitioning. Closely re-
lated sympatric species, if using similar resources (as _nothosaurus_ forms were all aquatic predators), are poten-
tial competitors so, to coexist normally diverge on one of three niche axes (space, time or food: Pianka 1973, 1986). In the case of the _nothosaurus_ of the Germanic Basin, according to Rieppel & Wild (1996) the most
important niche dimension segregating the _nothosaurus_ species should have been food: the sympatric species,
being of different size, avoided competition by presumably being characterized by different prey preferences.
The discovery of BES SC 1736 testifies that a pattern of
size differentiation and possibly trophic segregation may have also occurred for the _nothosaurus_ of the
Grenzbitumenzone, where a similar scenario has al-
ready been recognized for the predatory actinopter-
gian fish _Saurichthys_ (Rieppel 1992). Identifiable sto-
mach contents of _L. buzzii_ (skull fragments of a juvenile
cyamodontoid placodont, Tschanz 1989) suggest that
_Lariosaurus_ (_Silvestrosaurus_ _buzzii_ ) fed on proportion-
ally large, active prey rather than trapping smaller prey.
In fact _L. buzzii_ shares with _nothosaurus_ a skull mor-
phology and teeth suited for piercing and holding
(Rieppel 2002) which support this suggestion. The size
and typology of the stomach contents in BES SC 1736
are comparable with those of _L. buzzii_, despite the
greater dimensions of this latter, testifying that at least
a partial overlap in the range of prey dimensions oc-
curred between _N. cf. juvenilis_ and _L. buzzii_ (the latter
also being within the size range of potential prey for the
former). Studies on living aquatic organisms (e.g. Scharf
et al. 2000) have demonstrated that the range of prey
sizes expands with increasing predator body size, result-
ing in an asymmetric relationships between prey size
and predator size (as large predators continue to include
small prey in their diets). It is feasible that coexistence
in the same time and area of these two taxa with a partially
overlapping range of prey sizes was made possible by
habitat and/or microgeographical partitioning rather
than simply food-size partitioning.

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logistic support, and Fabio Fogliazza for the skillful preparation of
the specimen.

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**PLATE 1**

BES SC 1736, _Nothosaurus cf. N. juvenilis_. Skull and vertebral ele-
ments. A) Retroarticular processes of the lower jaw, portion of the quadrate
ramus of the pterygoid, of the quadrate in anatomical connection
with the lower jaw; several disarticulated cervical vertebrae are visible
between the two retroarticular processes; B) cervical neural arch,
ventral view; C) dorsal neural arch, dorsal view; D) dorsal neural arch
and spine, cranial view; E) caudal neural arch and spine, lateral view.
Scale bars equal 1 cm.

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**PLATE 2**

BES SC 1736, _Nothosaurus cf. N. juvenilis_. ribs. A) Dorsal ribs; B-C) cervical ribs; D) caudal ribs; E) median element
of a gastralia; F-I) sacral ribs. A, D-I, scale bars equal 10 mm, B, C
scale bars equal 0.5 cm.

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**PLATE 3**

BES SC 1736, _Nothosaurus cf. N. juvenilis_. Elements of girdles
and limbs. A) Clavicle; B) coracoid; C) humerus and ulna; D) femur; E) ilium; F) pubis and ilium turned upside-down with respect to the pubis; G)ischium. Scale bars equal 10 mm.

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**PLATE 4**

BES SC 1736, _Nothosaurus cf. N. juvenilis_. A) Radius; B) metacarpals (mc) and associated phalanges (ph); C)
astragalus (as), calcaneum (ca) metatarsals (mt) and a dissociated cau-
dal rib (cr); D) some of the unidentified stomach contents. Scale bars
equal to 1 cm.
A new specimen of Nothosaurus from the Middle Triassic of Besano Formation
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