

NEW PERLEIDIFORM FROM THE LOWER LADINIAN (MIDDLE TRIASSIC) OF THE NORTHERN GRIGNA (NORTHERN ITALY)

CRISTINA LOMBARDO, MARCO RUSCONI & ANDREA TINTORI

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Abstract. Based on a single specimen from a new site, located on the Northern Grigna or “Grignone”, near the city of Lecco (Lombardy), in the Buchenstein Formation (lower Ladinian), a new taxon belonging to the Perleidiformes is here described. This taxon represents a deep-bodied perleidiform, characterized by a marked hump before the dorsal fin, strongly ornamented scales and a peculiar dentition, made of pencil-like, long and slightly protruding, teeth. Among the other deep-bodied representatives of the order, this new taxon is considered to have more affinities with *Felberia*, described on material from the late Ladinian of Monte San Giorgio and from the Carnian of the Gorno Formation and Cave del Predil, and “*Dipteronotus*” *ornatus* from the late Anisian/early Ladinian of Monte San Giorgio.

The exploitation of the new site, started in September 2003, had brought to light until now approximately 900 finds, consisting in the majority of fishes. Despite the state of preservation is not optimal, also probably because of the remarkable heating suffered by the rocks, these finds prove a great diversity (with a fauna similar to that of Monte San Giorgio) and represent the first report of the presence of a fossil vertebrate level in the Buchenstein Formation all over the Southern Calcareous Alps.

Riassunto. Viene qui descritto un nuovo taxon appartenente all'ordine Perleidiformes sulla base di un unico esemplare proveniente da una nuova località sita sulla Grigna Settentrionale, o “Grignone”, vicino alla città di Lecco (Lombardia), nella Formazione di Buchenstein (Ladinico inferiore). Questo taxon rappresenta un perleidiforme a corpo alto, caratterizzato da una “gobba” pronunciata prima dell'inserzione della pinna dorsale, scaglie fortemente ornamentate ed una dentatura peculiare, costituita da denti a matita leggermente sporgenti e da denti trituranti emisferici. Tra gli altri rappresentanti a corpo alto di questo ordine, il nuovo taxon presenta maggiori affinità con il genere *Felberia*, descritto sulla base di materiale proveniente dal Ladinico superiore del Monte San Giorgio e dal Carnico della Formazione di Gorno e del Calcare di Cave del Predil e con la specie “*Dipteronotus*” *ornatus* dell'Anisico Superiore/Ladinico Inferiore del Monte San Giorgio.

Nel nuovo sito sono stati rinvenuti, a partire da Settembre 2003, circa 900 esemplari, per la maggior parte pesci. Sebbene lo stato di conservazione non sia ottimale, probabilmente anche a causa del forte riscaldamento cui la formazione è andata soggetta, questi reperti testimoniano una notevole biodiversità (con una fauna in parte simile a quella della parte superiore della Formazione di Besano del Monte San Giorgio) e rappresentano la prima segnalazione della presenza di un livello a vertebrati nella Formazione di Buchenstein nelle Alpi Meridionali.

Introduction

During a field excursion with students in 1981, one of us (AT) found some scattered fish remains in the lower part of the Buchenstein Formation (Early Ladinian) in the area of Scudo Tremare, on the southern slope of the Northern Grigna Mountain (locally said also Grignone), a few kilometers North of Lecco (Lombardy, N. Italy) (Fig. 1). Northern Grigna was already famous for its invertebrate faunas, like molluscs and brachiopods (Stoppani 1858-60; Rossi Ronchetti 1959, 1960; Gaetani 1969; Mantovani 2002), as well as for the fishes and reptiles described in the middle of the XIX century from around the village of Perledo, on the North-Western slope of the mountain (Bellotti 1857; De Alessandri 1910; Tintori & Lombardo 1999).

For many years additional sampling of possible new vertebrate levels in the Ladinian of the area was neglected, as most of the researches on the Middle Triassic vertebrates were focused on the Monte San Giorgio area, by far the most important European region for such fossils (Etter 2002). However, in the last years other new Middle Triassic sites in northern Italy (Braies Dolomites, Valcuvia/Valtravaglia, Mendola Pass, Gar-

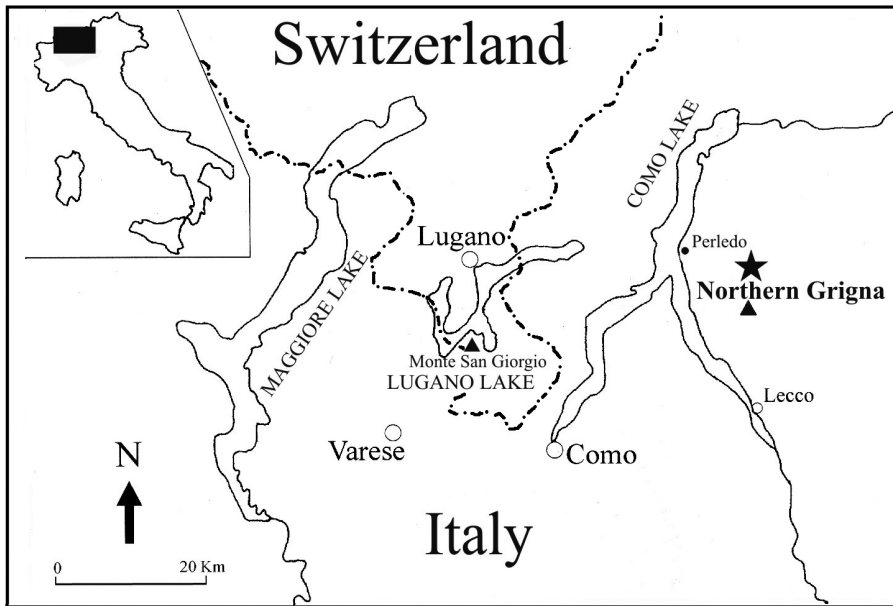


Fig. 1 - Geographic localization of the studied area.

dena Valley and this one in the Grigna Mountains) and in southern China (Guizhou Province), revealed that this period was very important for the evolution of both fishes and reptiles (Lombardo et al. 2005; Tintori & Lombardo 2005).

The new site is in the first creek East of the “Baita dello Scudo”, a small stone shelter used by local hunters. The outcrop consists of a series of limestones, marly-limestones, and limestones with flint beds or lenses, in layers cm-dm thick, with centimetric intercalations of clay and levels containing geods (even of decimetric dimensions), for a total thickness of about two meters. The lower and middle part of the level turned out to be particularly rich in fish specimens, while the upper beds hardly yield any, only a few bivalves of the genus *Daonella*, rare ammonoids as well as decapod and tilacocephal crustaceans, presently under study. The presence of large crustaceans, though quite rare, was a surprise, as they are extremely uncommon in many of the major Middle Triassic Fossil-Lagerstaetten.

The lithology of the level is not, at first glance, promising for well preserved vertebrates: each bed can occasionally be hardly splitted.

The excavations began in September 2003 (first explorative campaign of four days) and continued then in July 2004, July 2005 and July 2007, and had brought to light until now approximately 900 specimens, mainly fishes. The state of preservation is not optimal, probably because of the remarkable heating and tectonical stress suffered by the rocks. In fact the Grigna complex has been subjected to an increase of temperature, up to the deep diagenesis or even to the anchimetamorphism, since its IK (Index of illite cristallinity) is between 4 and 7 and CAI (Conodont Alteration Index) between

4 and 5, both suggesting a burial temperature of about 300°C (Gaetani et al. 1992).

The finds prove a great biodiversity (with a fauna similar to that from the upper part of the Besano Formation of Monte San Giorgio) and represent the first report of a vertebrate rich level in the Buchenstein Formation. From this latter unit, so far, only a few fish remains (*Placopleurus* and *Saurichthys*, AT pers. obs.) and part of a large ichthyosaur (Kuhn-Schnyder 1980) are known from the Seceda area (Gardena Valley).

Regarding fishes, the specimens need a long and careful preparation, as the rock is very hard and often uneven due to the presence of chert: so far, only about 60% of them have been identified at least at generic level. However, some of them may already be considered new taxa or they allow better description of previously known species. It is worth to cite a very large (much more than 1 meter) *Saurichthys* species, as well as several interesting “subholosteans” genera that are the subject of the PhD thesis of one of us (MR). Many small fishes (*Habroichthys* and *Placopleurus*) are found also on mass mortality layers.

The presence of *Habroichthys* and *Placopleurus* specimens in high numbers is considered typical of the latest Anisian/early Ladinian time interval in Western Tethys (Lombardo et al. 2005). These genera, together with ‘large’ *Peltopleurus* as well as other “subholosteans” known from the upper part of the Besano Formation in Monte San Giorgio, can be considered as the common part of the fish assemblage for that time interval all along the Tethys. Absence of genera such as *Colobodus* and *Ptycholepis*, quite common in the upper Besano Formation, may be due to a different environment for the Buchenstein basin.



Fig. 2 - View of the studied area. The arrow points to the “Baita dello Scudo” (the small stone shelter used by local hunters); the asterisk marks the excavation site.

Geological setting

The Grigna complex, bordered in the western part by the Como Lake and in the eastern part by the Valsassina, is a group geographically belonging to the Prealpi Lombarde. The Grigna complex consists of three overlapped thrusts, each constituting one of the three most important mountaintops, the Grignone for the northern, the Grignetta for the central and Coltignone Mountain for the southern thrust of the complex (Gaetani et al. 1992).

The Buchenstein Formation has been introduced in 1860 by von Richtofen, in Livinallongo, in the eastern part of Northern Italy. It consists essentially of regularly stratified limestones, with bed thickness between 10 and 30 cm, at times marly or dolomitic, blue-grey at surface and dark in fracture, with nodules, lens or beds of black flint. Between the layers there are often clayey, clayey-marl, or tuffaceous joints. Sometimes there are intercalations of light-yellow, orange or red pyroclastites, usually one to few dozens of cm-thick. A pack of silvery marls, brown-grey, blue-grey or green-grey coloured, where the tuffaceous levels are mainly localized, is intercalated in the limestone's sequence (Pasquarè & Rossi 1969; Brack et al. 2005).

The thickness of the unit in the Grigna area ranges from 100 to 150 meters. The lower limit is always with Prezzo Limestone, while the upper limit is here with the Esino Formation, well detected by the transition from stratified black limestones with flint to massive white limestones proving the filling of the basin by the prograding of the carbonate platform (Fig. 2).

The depositional environment of the Buchenstein Formation consists of a relatively deep intra-platform basin, with quiet bottom, interested by more or less extended low oxygen to anoxic events, bordered by

the carbonate platform of the Esino Formation. The Buchenstein Fm. represents the culminating moment of the facies differentiation that characterizes the Middle Triassic of the Southern Alps and the maximum depth in the intraplatform basins. This unit was deposited at the bottom of basins, whose depth was probably around 100-300 m; in those depressions the micrite and bioclastic debris, washed away from the nearby carbonate platforms, were accumulated, sometimes in a very quiet and oxygen-poor environment. The abundance of silica is related to the blooming of radiolarians, favoured also by the silica saturation of marine waters due to volcanic activity. Subsidence and sedimentation rates were somewhat high (more than 100 meters per MY; Gaetani et al. 1992), more than detected in other areas, with the same formation crops out, like in the Central and Western Dolomites, where a sedimentation rate of about 10 meters per MY has been counted (Brack & Muttoni 2000).

Recently, sampling for conodonts has been carried out from the fossiliferous outcrop; the analysis of the samples has revealed the presence of *Pseudofurnishius priscus* Sadeddin, 1990 and *Budorovignathus troempyi* (Hirsch, 1971). Owing to the presence of these species, it has been possible to date with good approximation the fish levels as lower Fassanian (upper *curionii* zone), near the Anisian-Ladinian boundary (Nicora & Rusconi 2007). So we can tentatively correlate the fish levels of the Northern Grigna with the upper part of the Besano Formation or, at the most, with the overlying lowermost part of the San Giorgio Dolomite, a barren unit in the Monte San Giorgio area.

Abbreviations used in figures: br, branchiostegal rays; cl, cleithrum; d, dentary; dhy, dermohyal; dpt, dermopterotic; dsph, dermosphenotic; exsc, extrascapulars; ifo, infraorbital bones; l, left; mx, max-

illa; na, nasal; op, operculum; pmx, premaxilla; pop, preoperculum; ptt, posttemporal; r, right; ro, rostral bone; scl, supracleithrum; sop, suboperculum.

Institutional abbreviations: MPUM: Museo di Paleontologia Università degli Studi di Milano.

Systematic Paleontology

Perleidiformes Berg, 1940

Polzbergiidae Griffith, 1977

Stoppania gen. n.

Diagnosis: deep-bodied perleidiform; narrow opercular region with suboperculum larger than operculum; vertical preoperculum showing symmetrical dorsal and ventral regions and a well developed infraorbital process; premaxillary smooth, with a long posterior process contacting the dorsal region of the maxilla; long prehensil teeth slightly protruding, with conical cusps, borne by premaxillary and dental; crushing teeth present; scales much deeper than broad in the lateral region of the trunk and rhombic in the area near the caudal fin, strongly ornamented; patch of small scales on the base of the anal fin. Long dorsal fin; caudal fin with at least seven epaxial fin rays.

Etymology: dedicated to Antonio Stoppani (1824 - 1891), famous geologist and palaeontologist native of Lecco, one of the pioneers of Italian paleontology, who worked mainly in the Grigna Mountains.

Age: late Anisian-early Ladinian (Middle Triassic).

Geographical distribution: Northern Grigna (Italy), Monte San Giorgio (Canton Ticino, CH) and Landwassertal (Kanton Graubunden, CH).

Type species: *Stoppania gaetanii* gen. n. sp. n.

***Stoppania gaetanii* n. sp.**

Figs 3-5

Diagnosis: *Stoppania* of an estimated size of 25 cm in SL; seven teeth borne by premaxillary and six by dentary; crushing teeth hemispherical; skull ornamentation made of small rounded tubercles regularly and densely arranged on each element, except the premaxillary; squamation made of 45 transverse rows of scales, strongly ornamented by ganoine tubercles, differently arranged on the lateral, dorsal and posterior region of the body; scales of the caudal peduncle smooth with a homogeneous ganoine covering and denticles on the posterior margin.

Etymology: from Prof. Maurizio Gaetani, for his outstanding contribution to the geology and paleontology knowledge of the Grigna Mountains in the last decades.

Holotype: specimen MPUM 9542.

Type locality: Scudo Tremare site, Northern Grigna (Northern Italy).

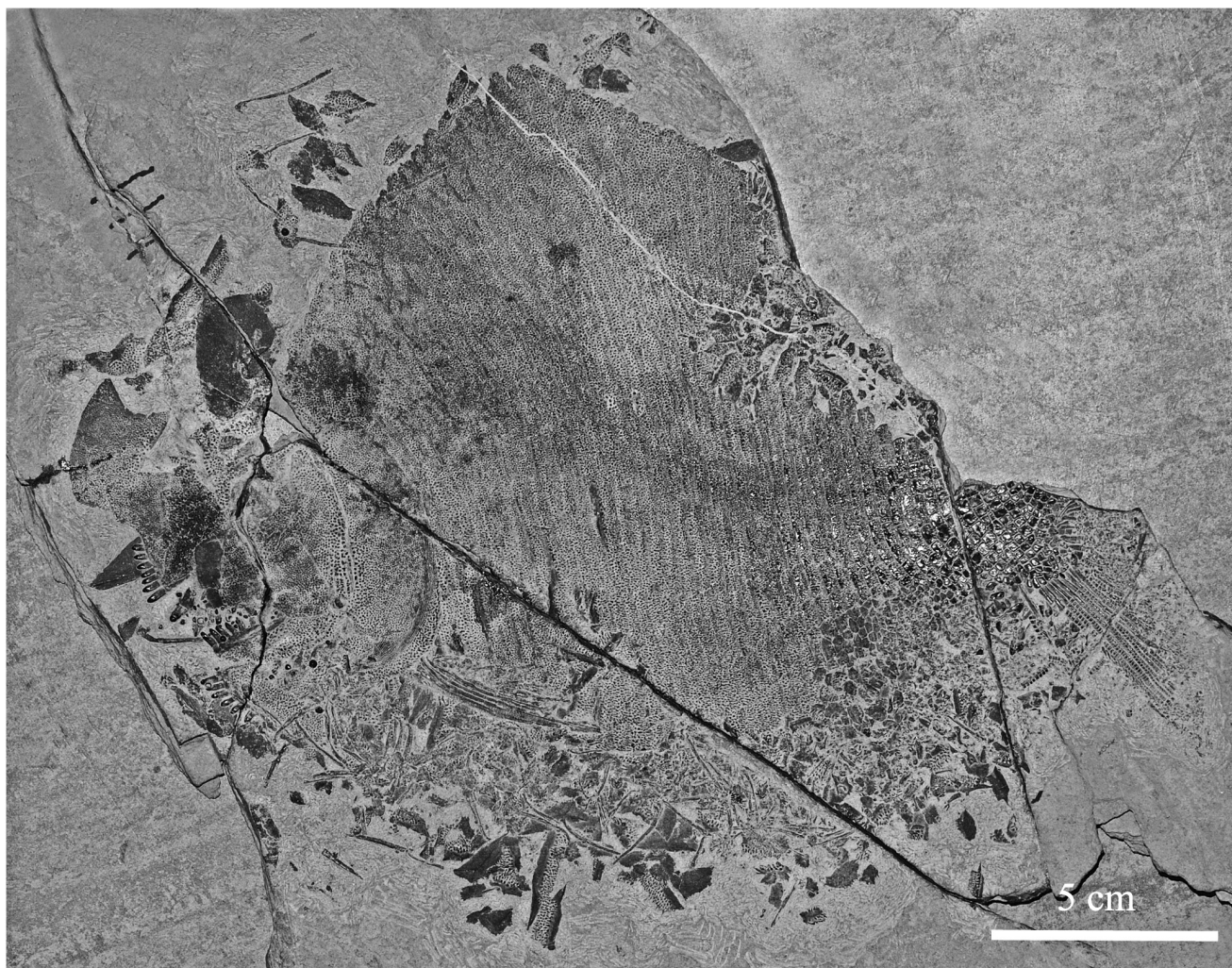


Fig. 3 - *Stoppania gaetanii* gen. n. sp. n., holotype MPUM 9542.

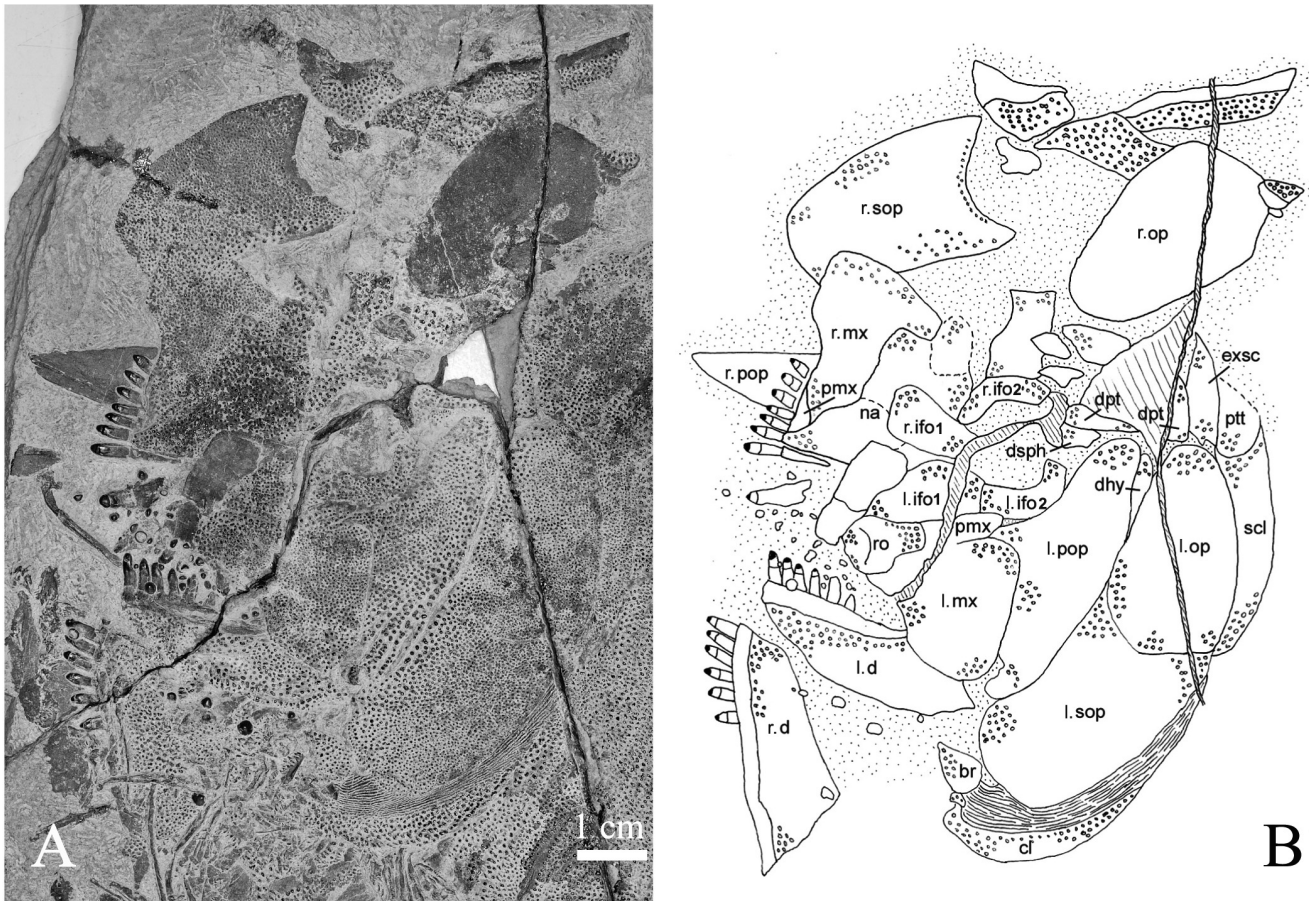


Fig. 4 - *Stoppania gaetanii* gen. n. sp. n., holotype MPUM 9542; A) photograph of the skull; B) camera lucida drawing.

Age: early Ladinian (Middle Triassic) from the Buchenstein Formation.

Description

Skull (Fig. 4). The bones are strongly ornamented, with ornamentation made by small ganoine tubercles that often render difficult the identification of the sutures between the osseous elements, as well as the observation of the pores corresponding to the sensorial canals. The only exception is represented by the anterior part of the premaxillary, which is smooth.

The large rostral bone is pentagonal-shaped: it is one of the few elements where the course of the sensory commissure is well visible, on the ventral region of the bone. An element that partially overlaps the right premaxillary has been interpreted as the right nasal. This element presents an anterior pointed tip and a faint notch on the medium part, that should represent the nostril, is visible. Two fragments in contact ventrally with the dermosphenotic and posteriorly with the extrascapular are assigned to the dermopterotic, whose overall shape and size are not observed. The dermosphenotic is a small and triangular-shaped element, in contact with the dermopterotic and the antero-dorsal part of the preoperculum. Two infraorbitals on each side are visible; on the left side of the skull the two

elements are supposedly in their original position, with Ifo2 crescentic in shape placed in the postero-ventral corner of the eye socket and posteriorly in contact with the preoperculum; Ifo1, which contacts the premaxillary, is much larger and trapezium-shaped. On the right side of the skull it is possible to recognize, even if partially disarticulated, the same elements with similar characteristics. Both the right and left opercular bones are shown (the latter visible from the medial side and disarticulated). They are oval, with height about 150% its width, and the ventral border is concave. Slightly larger than the operculum, the suboperculum has sub-rectangular shape with height 200% its width. The dermohyal is a small element triangular-shaped, anteriorly in contact with the postero-dorsal part of the preoperculum and posteriorly with the antero-dorsal region of the operculum. The vertical preoperculum is a large plate with dorsal and ventral regions sub-equal in size. The ventral part has a slender end, while the terminal part of the dorsal one is more rounded. A well developed infraorbital process is visible. The right preoperculum is disarticulated and visible from its medial side, partially covered by the right maxillary. The two maxillaries are only partly visible, being covered by other bones. They show a dorsally expanded triangular re-

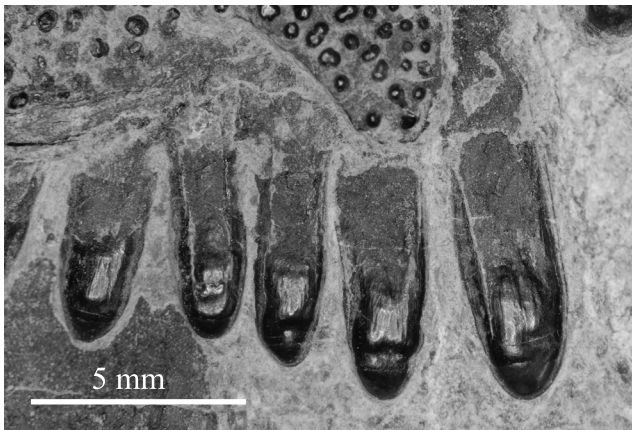


Fig. 5 - *Stoppania gaetanii* gen. n. sp. n., holotype MPUM 9542; detail of teeth borne by the premaxillary.

gion. On the left maxillary the dorsal margin is visible, contacting the premaxillary. The ventral margin is slightly wavy in the median region. The maxilla does not bear teeth. The premaxillary consists of an anterior triangular region and a long posterior process, in contact, but not sutured entirely, with the dorsal part of the maxillary all through its length. The oral margin, lacking ornamentation, brings seven pencil-like teeth, long and slightly protruding; their height decreases posteriorly. Each tooth exhibits an acrodine cusp, conical and rounded (Fig. 5).

The dentary is wedge-shaped, elongated, and it presents the oral margin devoid of ornamentation. Both the element are preserved and visible, and they bear six teeth similar to those of the premaxillary, with regard to their shape and dimensions. Only one extrascapular is visible; it is triangular and elongated in dorso-ventral direction, placed between the dermopterotic anteriorly and the post-temporal postero-ventrally. Postero-dorsally it is in contact with the first row of scales.

The post-temporal is not well observable; it apparently shows rhombic shape but its dorsal margin is not visible. It is in contact with the supracleithrum postero-ventrally. The supracleithrum is sickle-shaped and very elongated dorso-ventrally; it is in contact anteriorly with the operculum all throughout its length and antero-dorsally with the post-temporal. The ventral tip is placed at the same level than the suture between operculum and suboperculum. The crescentic-shape cleithrum is covered on its anterior part by the suboperculum. The anterior part of the element presents a particular ornamentation made of longitudinal narrow ridges, dorso-ventrally elongated, and arranged side by side, while the posterior part presents the usual tuberculated ornamentation.

Due to the state of preservation of the ventral region of the skull, only one branchiostegal ray is visible; it is small and sub-triangular, placed anteriorly to the cleithrum.

Squamation. Forty-five vertical rows of scales have been counted (Figs 3, 6). The scales have a different morphology and ornamentation in the different regions of the body (Fig. 6). In the antero-lateral region of the flank the scales are very dorso-ventrally elongated (their height equals six times their width). They present an ornamentation consisting of small rounded tubercles of ganoine, sprawling arranged on their surface; the exception is represented by some scales that show larger tubercles arranged in a row on the anterior part. The height of the scales decreases both posteriorly and dorso-ventrally. At about the level of the maximum height of the body the ornamentation changes: on the posterior part of the scales there are small tubercles that tend to merge. The scales of the dorsal region show shape and ornamentation more homogeneous: these are rhombic elements, all covered by rounded tubercles slightly larger than those of the median region. There is a mid-dorsal ridge row, made of shield-like scales showing the same kind of ornamentation. The ventral region of the body is covered by scales similar in shape to those of the lateral line, but smaller. It is not possible to give a detailed description of the scales between the pectoral and the anal fins, since this area of the body is completely disarticulated; however, at the base of the anal fin there is a squarish area with very small sub-circular scales, ornamented by a few elongated tubercles. In the area of the caudal peduncle the scales become smaller and rhombic, with most part of the surface covered by a thick smooth layer of ganoine; the posterior margin shows few denticles.

The presence of many isolated scales allows to observe the very well developed “peg and socket” articulation. Moreover it is possible to note that the ornamented surface of the scales is larger than the smooth anterior one.

Fins. The only fin observed is the caudal one, although it is incomplete, because it lacks part of the axial lobe and the rays of the dorsal lobe. It is possible to count at least 12 lepidotrichia in the ventral lobe, made by short proximal elements and square distal segments that branch at least once. The tip of the fin appears completely disarticulated.

Taphonomic remarks. The holotype of *Stoppania gaetanii* gen. n. sp. n. (so far the only known specimen) is incomplete, lacking the postero-dorsal part of the body. The state of preservation is quite peculiar: most of the body is completely articulated, although the ventral and postero-dorsal regions of the trunk are covered by scattered scales. Due to this particular preservation, it is not possible to describe the pelvic and the anal fins, whose scarce elements are disarticulated. The dorsal fin and the dorsal lobe of the caudal fin are missing. Many bones of the skull are disarticulated, some are missing or

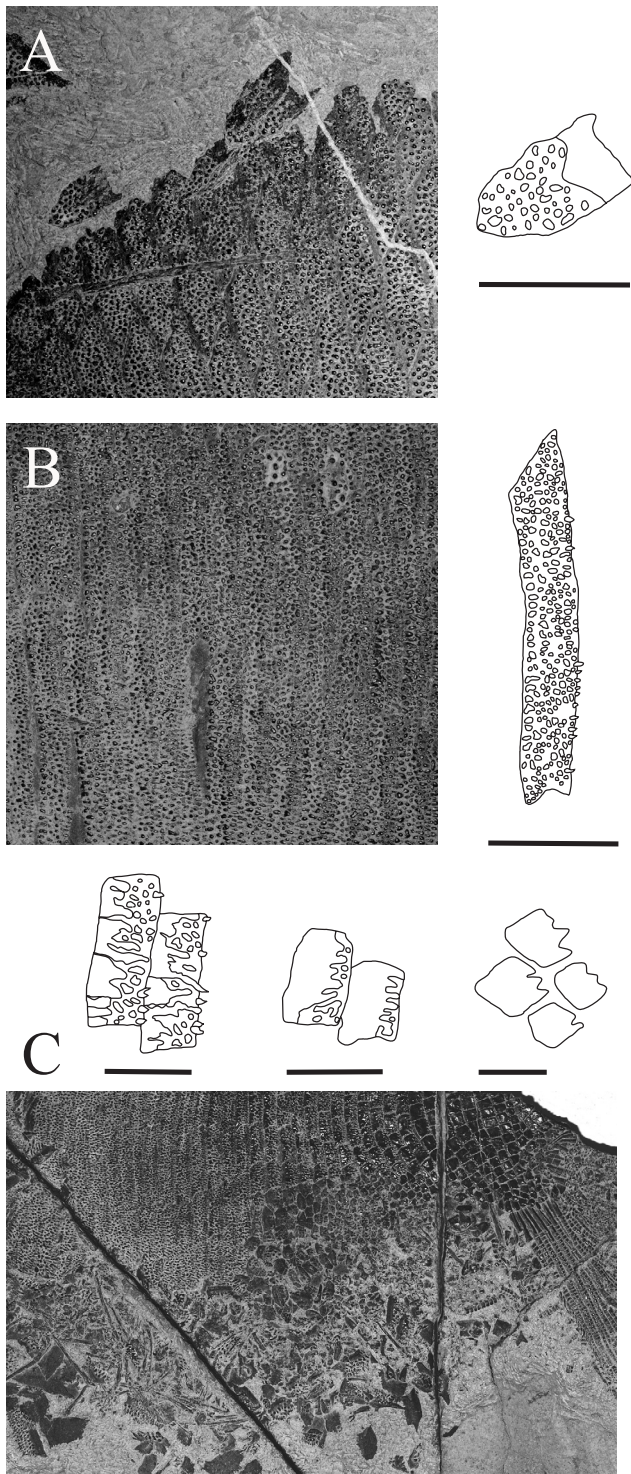


Fig. 6 - *Stoppania gaetanii* gen. n. sp. n., holotype MPUM 9542; the squamation, showing the different patterns of ornamentation; A) mid-dorsal scales; B) scales of the anterolateral region of the flank; C) three types of scales of the postero-ventral region of the body. Scale bars = 5 mm.

not visible, while for some others the right and left elements are visible, e.g. upper and lower jaws, opercular region, infraorbitals, and preoperculum.

Skull bones not in anatomical connection are often the case for several other medium-sized fishes from the vertebrate level in the Buchenstein Formation.

Furthermore, the postero-dorsal region of this specimen is lacking (Fig. 3). As usually, decomposition must have started in the abdominal cavity, leading to disarticulation mainly in this region, but the fact that the postero-dorsal part is almost destroyed should be interpreted as due to taphonomical processes other than decomposition. Scavenging action is not plausible, because of the disaerobic/anoxic conditions of the bottom. Predation may be involved in such kind of preservation, as also other large fish specimens shows traces of traumatic ruptures (Tintori 2007).

Stoppania ornata (Bürgin, 1992) n. comb.

1992 *Dipteronotus ornatus* Bürgin, p. 100, figs 117-123.

2004 *Dipteronotus ornatus* Lombardo & Tintori, p. 191.

Diagnosis (emended): species of *Stoppania* with a rounded outline of the dorsal hump; squamation made of 40 scales rows, all densely ornamented by small rounded tubercles, also on the caudal peduncle; the scale ornamentation is similar all over the body.

Stratigraphical distribution: Besano Formation and lower Meride Limestone.

Remarks. The comparison of the material from Northern Grigna with the species *Dipteronotus ornatus* Bürgin, 1992 confirms what has already been pointed out by Lombardo & Tintori (2004): this species from the late Anisian/early Ladinian of Monte San Giorgio cannot be assessed to the genus *Dipteronotus*. Although *Dipteronotus* shows some superficial similarities with *Stoppania* gen. n. having a deep-bodied morphology and a perleidid skull pattern, the two taxa are different in the shape of preoperculum, shape and size of the opercular region and for the morphology of upper and lower jaws; in addition, in *Stoppania* gen. n. the dorsal crest made by elongated ridge scales, which is diagnostic for *Dipteronotus* (Tintori 1990), is lacking and the scales are much deeper than broad and heavily ornamented; therefore we suggest to move the species *Dipteronotus ornatus* from *Dipteronotus* to the new taxon *Stoppania*.

The species from Monte San Giorgio differs from the type species of *Stoppania* gen. n. in the dorsal outline of the body, rounded instead of pointed, the number of transversal scale rows, 40 vs. 45, and the pattern of ornamentation of scales, more homogeneous over the whole body in *S. ornata*. Isolated scales from the Pro-santo Formation of Landwassertal (Kanton Graubunden, Switzerland), described in Bürgin et al. (1991) as *?Dipteronotus*, can be also assigned to the new genus.

Discussion

The new genus here described is assigned to the order Perleidiformes, on the basis to the following characters: a large rostral dividing the nasals, dorso-poster-

iorly expanded maxillary contacting the anterior margin of a dorsally expanded and vertically oriented preoperculum, large opercular region, dorso-ventrally elongated dermosphenotic, flank scales deeper than broad on the anterior region of the body, radials equal in number to lepidotrichia and caudal fin with epaxial rays (Gardiner 1988; Gardiner & Schaeffer 1989; Bürgin 1992; Tintori & Lombardo 1996).

Within this order, the following families are recognized at present: Platysiagidae, Luganoiidae, Gabanellidae, Colobodontidae, Perleididae and Cleithrolepididae (Brough 1931; Hutchinson 1973; Gardiner 1988; Bürgin 1992; Tintori & Lombardo 1996; Mutter 2004). Moreover, another family, the Polzbergiidae, erected by Griffith (1977) within his new order Polzbergiiformes, has been tentatively assessed to the order Perleidiformes by Lombardo & Tintori 2004, questioning the validity of the order Polzbergiiformes.

Concerning the Platysiagidae, the only genus included in this family does not show the typical features of the order Perleidiformes, so, in our opinion, it should be removed from it and placed within Palaeonisciformes; *Platysiagum* is in fact characterized by a long narrow maxillary, only slightly expanded posteriorly, and by a remarkably heterocercal caudal fin, lacking epaxial rays (Bürgin 1992).

The assessment of the new genus to the Luganoiidae, Gabanellidae or Colobodontidae is clearly excluded, being these families of fusiform perleidiforms completely different, besides the general body morphology, also for the pattern of the skull, both the outline and the shape and size of its bones (e.g.: maxillary, preopercular bones, infraorbitals series, dentition). On the contrary, the comparison with the deep-bodied groups (Cleithrolepididae, part of the Perleididae and Polzbergiidae) is more complex and problematic. Additionally, some comparisons have been made with taxa showing similar dentition as well (e.g. *Ctenognathichthys*).

The new taxon shares with the representatives of the family Cleithrolepididae, especially with *Cleithrolepis*, the rhombic outline of the body, the dorsal and anal fins placed near the caudal fin, the morphology of scales rich in ornamentation, the suboperculum larger than the operculum, and the very deep and triangular postorbital region of maxillary (Hutchinson 1973).

Nevertheless, there are substantial differences between the two genera in the mouth structure: *Cleithrolepis* is in fact characterized by a narrow lower jaw devoid of teeth. *Stoppania* gen. n. is different also from *Hydropessum* in the shape of the preoperculum, the dentition and the advanced position of the dorsal fin (Hutchinson 1973).

Concerning the Perleididae, the new taxon is compared with two genera: *Dipteronotus* (Egerton, 1854; Gall et al. 1974; Tintori 1990) and *Cteno-*

gnathichthys (Bürgin, 1992). *Dipteronotus* is the only representative of this family with a moderately deep body, whereas the fusiform *Ctenognathichthys* shows a dentition made of long, protruding marginal teeth.

Comparing *Stoppania* gen. n. with *Dipteronotus*, the outline of the body is definitely deeper in the former taxon, and the morphology of the scales is different. Contrary to the remarkable deeper than broad flank scales visible on *Stoppania* gen. n., in *Dipteronotus* these scales are similar in size to those of the dorsal and ventral regions of the body. Moreover, the main characteristic of *Dipteronotus*, its dorsal crest made of elongated dorsal ridge scales, lacks in *Stoppania*; the scales of *Dipteronotus* are smooth, except for a small spine on the posterior margin, whereas the scales of *Stoppania* gen. n. are heavily ornamented. The dentition is also different, since *Dipteronotus* shows only a long row of peg-like teeth, typical of non-specialized perleidiforms. With *Ctenognathichthys* the only seeming resemblance is provided by long marginal teeth bent inward: this genus is in fact a medium sized, fusiform perleidid, with a squamation made of scales slightly deeper than broad on the antero-lateral region of the body; its skull is characterized by a preoperculum postero-dorsal antero-ventral directed, and the operculum is smaller than the suboperculum. Morphologically, the teeth of *Ctenognathichthys* are different from those of *Stoppania* gen. n.: the former genus has conical, slender and bent teeth, arranged on a single row on the upper jaw and on at least two rows on the lower one (Bürgin 1992 and pers. obs.); the longest teeth are borne by the premaxillary. In *Stoppania* gen. n. teeth are pencil-like, long and stout, ending with a rounded enamel cusp and arranged on a single row both on upper and lower jaws. The upper teeth are borne by the premaxillary only, while in *Ctenognathichthys* also the maxilla bears several teeth.

Among the deep-bodied perleidiforms, *Felberia* is morphologically similar to the new taxon (Lombardo & Tintori 2004). They both share: the rhombic outline of the body; very deep flank scales, which show a strong ornamentation; a smooth premaxillary with a long process contacting the whole dorsal region of the maxilla; a vertical preoperculum showing symmetrical dorsal and ventral regions and with a well developed infraorbital process; the general morphology of teeth is also similar. Among the differences, there are: suboperculum larger than operculum, different pattern of ornamentation of the scales, a lower number of prehensil teeth, less protruding than in *Felberia*. Moreover, the prehensil teeth of *Felberia* are characterized by a spatulated apex (Lombardo & Tintori 2004) and the genus seems to lack crushing teeth, present in *Stoppania* gen. n. These differences (mainly the ratio operculum/suboperculum and the dentition characters) do not allow to assign

the new taxon to the genus *Felberia* but it is reasonable to assess it to the same family as a new genus.

Felberia has been attributed to the Polzbergiidae due to the presence of several characters shared by *Felberia* and *Polzbergia* (although this genus had been erected on a poorly preserved specimen), such as the body shape and morphology and ornamentation of scales, the long prehensil teeth present only on the anterior part of the jaws and the position of the fins (Griffith 1977; Lombardo & Tintori 2004). We believe that also

Stoppania gen. n. should be attributed to the same family, pending a revision of the whole order.

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