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Mesozoic marine reptiles of Russia and other former Soviet republics

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Introduction

Marine reptile remains have often been found in the extensive Mesozoic epicontinental marine units of the former Soviet Union, and in particular, the Russian Platform of the European part of Russia. These fossils include relatively common plesiosaurs, ichthyosaurs and mosasaurs, and rarer crocodilians and turtles. The Moscow Basin and the Ul'yanovsk, Samara, and Saratov regions of the Volga River Basin have been particularly productive. These areas not only contain large exposures of Upper Jurassic and Cretaceous sediments, but have proved relatively accessible to Russian workers over the years. Sadly, there has been little in-depth study and analysis of marine reptile fossils in the former Soviet Union in recent years, although a great many historical works have been devoted to them. In this article, we review the current state of knowledge of these interesting fossils and provide a basis for informed future study.

The quality of most Russian marine reptile holotypes is poor and most specimens have been recovered as float from the Volga and Moscow River Basins, or as chance occurrences in quarries and oil shale mines. Almost no deliberate excavations have been undertaken. Currently, the most productive Russian localities for plesiosaurs and ichthyosaurs are the phosphorite quarries near Voskresensk in the Moscow Region, quarries near the village of Sundokovo in Tataria, the vicinity of Kashpir in the Samara Region (Upper Jurassic to Aptian), the 30 km of Volga River shoreline from the village of Kriushi to Mordovo (Barremian to Albian), and the 24 km stretch of the Volga from Ul'yanovsk to Undory (Kimmeridgian to Aptian). The phosphorites typically produce only fragmentary and disarticulated remains, but complete skeletons are common in the clays, shales, and marls of the Volga. There is good potential for discoveries in other quarries, but these are currently unmonitored. Historical localities of the Moscow Region generally no longer exist, as these quarries have been abandoned over time. The best potential for immediate results therefore lies with the excellent cliff-face exposures along the Volga.

Numerous Russian reports refer to localities in 'Povolzh'e' or 'Zavolzh'e'. These are Russian conventions for the Volga River Basin, Povolzh'e indicating the right bank of the river (Ul'yanovsk and Saratov shore; west bank), and Zavolzh'e the left (Samara shore; east bank). In the central Volga Basin near Ul'yanovsk, marine reptile remains have been found in all ammonite zones from the Callovian to the Albian. The greatest concentrations, however, occur in the Middle Volgian *Dorsoplanites panderi*, *Epivirgatites nikitini*, and Upper Volgian *Craspedites subdites* ammonite zones and in the Hauterivian *Speetoniceras versicolor* Zone. Uniform formational or 'svita' (suite) names have not been established generally for the Russian Platform marine rocks, and the use of local ammonite zones is preferred. The Russian Volgian essentially equals the Tithonian.

Lower Volga sediments producing ichthyosaurs, plesiosaurs, mosasaurs, and turtles in the Saratov and Penza Regions (Povolzh'e) are Senonian in age, typically Campanian and Maastrichtian. The precincts of the Serdoba River near the village of Malaya Serdoba, Penza, have been particularly rich in fragmentary remains of Campano-Maastrichtian age (pers. obs.,

M.S.A.). Jurassic and Cretaceous marine deposits containing fossil reptile remains are also found in some of the central Asian nations that were formerly republics of the Soviet Union, but these areas have been less well studied. Kazakhstan, Uzbekistan, and Azerbaijan are notable examples (Bazhanov, 1958; Rozhdestvenskii, 1973; Nesov and Krasovskaya, 1984; Glikman *et al.*, 1987).

Repository abbreviations

KGU, Geology and Mineralogy Museum, Kazan State University, Kazan'; MGRI, Moscow Geological Prospecting Institute, Vernadskii State Geological Museum, Moscow; PIN, Paleontological Institute, Russian Academy of Sciences, Moscow; PMK, Pugachev Regional Museum, Pugachev, Saratov region; POKM, Penza Regional Local History Museum, Penza, Penza Region; SGU, Paleontology Museum of the Department of Historical Geology and Paleontology, Saratov State University, Saratov; 'Simbirtsit', Paleontological collection of the 'Simbirtsit' Industrial Works (a free enterprise company), All-Russian Cultural Fund, Undory, Ul'yanovsk Region; TsGM, Central Geological Museum, St. Petersburg; UPM, Undory Palaeontological Musuem, Undory, Ul'yanovsk region; ZIN, Zoological Institute, Russian Academy of Sciences, St. Petersburg.

Systematic survey

DIAPSIDA Osborn, 1903

SAUROPTERYGIA Owen, 1860

PLESIOSAURIA de Blainville, 1835

Comments. Over two dozen plesiosaur species have been named, and numerous additional taxa recognized, from Russian sediments by Russian and German workers. Most of this effort was undertaken in the pre-revolutionary years of the nineteenth and early twentieth centuries (e.g. Fischer von Waldheim, 1845, 1846; Eichwald, 1865–1868; Kipriyanov, 1883; Ryabinin, 1909, 1915; Bogolyubov, 1911; Pravoslavlev, 1915, 1916). Zhuravlev (1941, 1943), Rozhdestvenskii (1947), Menner (1948), Novozhilov (1948a, b, 1964), and Ochev (1976a, 1977), for example, have written on Russian plesiosaur remains more recently. Little study has been attempted in the past 20 years. Older workers (e.g. Bogolyubov, 1911; Menner, 1948) sometimes relied upon disassociated collections of bones for their type series. Where possible, holotypes in these cases have been selected on the basis of page priority.

Bogolyubov (1911) named numerous Russian plesiosaur species all of which, however, are indeterminate and must be considered *nomina dubia* (Table 11.1), even though some of these were retained by Pravoslavlev (1915) (see Welles, 1962). Indeed, virtually all of the 'species' unique to Russia are *nomina dubia*, and not a single complete skeleton has been described. Most are based upon isolated vertebrae and teeth and as such are non-diagnostic below the subordinal, or perhaps the familial level. Most, if not all, of Bogolyubov's (1911) holotypes, from the old museum of the Geological Cabinet of Moscow University, are now housed in MGRI. Some of these types have been identified (Table 11.1), but through neglect while under communist authority, parts of the collection are inaccessible. It is believed that a planned renovation project, now underway, will uncover the remaining specimens. Kipriyanov's (1882, 1883) material is presumably in the museum of the Academy of Sciences, St. Petersburg. The whereabouts of other collections, such as those of Eichwald and Fischer von Waldheim, are unknown at present.

Ostensibly, the genera *Cimoliasaurus*, *Colymbosaurus*, *Cryptoclidus*, *Elasmosaurus*, *Eretmosaurus*, *Georgiasaurus*, *Leutkesaurus*, *Liopleurodon*, *Muraenosaurus*, *Neoplesiosaurus*, *Peloneustes*, *Plesiosaurus*, *Pliosaurus*, *Polycotylus*, *Polyptychodon*, *'Rhinosaurus'*, *Scanisaurus*, *Simolestes*, *Spondylosaurus*, *Strongylokrotaphus*, and *Thaumatosaurus* are present in Russian rocks (Welles, 1962; Persson, 1963; Novozhilov, 1964). However, most generic identifications and assignments to previously known Western taxa have been based upon stratigraphical, rather than morphological information, with an historical readiness to name new species based upon geographic occurrence. Few of these identifications can be considered reliable. Indeed, most Western species

Table 11.1. *Compilation of plesiosaurian taxa based upon material from the former Soviet Union. Holotypes indicated by repository abbreviation or specimen number, where known*

Taxon	Holotype	Material	Locality	Horizon	Status
Colymbosaurus sklerodirus Bogolyubov, 1911	MGRI	fragmentary skeleton	Moscow Region	Volgian	Plesiosauria indet.
Cryptoclidus simbirskensis Bogolyubov, 1909	MGRI	vertebrae/limb frags.	Ul'yanovsk Region	Callovian–Oxfordian	Plesiosauria indet.
Elasmosaurus amalitskii Pravoslavlev, 1916	—	vertebral series	Don Region	Turonian	Elasmosauridae indet.
Elasmosaurus antiquus Dubeikovskii & Ochev, 1967	SGU 104a/17, 18, 19	cervical centra	Kama River Basin	Hauterivian	Elasmosauridae indet.
Elasmosaurus kurskensis Bogolyubov, 1911	MGRI [Kipr., 1882]	med. cervical centrum	Kursk Region	Cenomanian	Plesiosauria indet. [see Welles, 1962]
Elasmosaurus orskensis Bogolyubov, 1911	MGRI	cervical centra	Orenburg Region	Senonian	Elasmosauridae indet.
Elasmosaurus serdobensis Bogolyubov, 1911	MGRI	ant. cervical centrum	Penza Region	Campanian	Elasmosauridae indet.
?*Elasmosaurus sachalinensis* Ryabinin, 1915	—	phalanx	Sakhalin Island	Lower Senonian	Plesiosauria indet.
Eretmosaurus rzasnickii Menner, 1948	MGRI VI 61/1	cervical centrum	Vilyui River, Siberia	Middle Jurassic	Plesiosauria indet.
?*Eretmosaurus jakowlewi* Menner, 1948	MGRI VI 61/15	caudal centrum	Vilyui River, Siberia	Middle Jurassic	Plesiosauria indet.
Georgiasaurus (*Georgia*) *penzensis* (Ochev, 1976a)	POKM No. 11658	partial skull/skel.	Penza Region	Santonian	presumed valid
Leutkesaurus [no sp.] Kipriyanov, 1883	ZIN?	teeth and vertebrae	Kursk Region	Cenomanian	?*Polyptychodon* sp.
Muraenosaurus elasmosauroides Bogolyubov, 1911	MGRI	cervical centrum	Moscow Region	Volgian	?Elasmosauridae indet.
Muraenosaurus kamensis Dubeikovskii & Ochev, 1967	SGU 104a/16 [lost]	cervical vertebrae	Kama River Basin	Volgian	?Elasmosauridae indet.
Muraenosaurus purbecki Bogolyubov, 1911	MGRI	centrum	Moscow Region	Volgian	Plesiosauria indet.
Neopliosaurus [no sp.] Sintzov, 1899	—	vertebrae/humeri	Penza Region	Senonian	?Polycotylidae indet.
Plesiosaurus helmerseni Kipriyanov, 1882 (emend. Bog. '11)	ZIN	cervical centrum	Penza Region	Campanian	Elasmosauridae indet. [see Persson, 1959]
Plesiosaurus nordmanni Eichwald, 1865	—	propodial fragment	Crimea	Neocomian	Ichthyosauria indet. [see Ryabinin, 1946b]
Pliosaurus giganteus Trautschold, 1860	—	tooth	Moscow Region	Oxfordian	*Liopleurodon ?ferox*
Pliosaurus rossicus Novozhilov, 1948a	PIN 304	partial skull/skel.	Chuvashia	Volgian	*Liopleurodon rossicus* [see Halstead, 1971]

Table 11.1. (*cont.*)

Taxon	Holotype	Material	Locality	Horizon	Status
Pliosaurus wosinskii Fischer von Waldheim, 1846	—	jaw fragment	Moscow Region	Kimmeridgian	?*Pliosaurus brachyspondylus*
Polycotylus brevispondylus Bogolyubov, 1911	MGRI	pectoral vertebra	unknown	Cenomanian	Polycotylidae indet.
Polycotylus donicus Pravoslavlev, 1915	—	cervical centra, etc.	Don Region	Senonian?	?Polycotylidae indet.
Polycotylus epigurgitis Bogolyubov, 1911	MGRI	posterodorsal centrum	Voronezh Region	Cenomanian	Plesiosauria indet.
Polycotylus ichthyospondylus var. *tanais* Bogolyubov, 1911	MGRI	vertebrae/propodial	Voronezh Region	Cenomanian	Polycotylidae indet.
Polycotylus orientalis Bogolyubov, 1911	MGRI (Sa109, 110 etc.)	centra/limb frags.	Orenburg Region	Senonian	?Polycotylidae indet.
Polycotylus ultimus Bogolyubov, 1911	MGRI	2 cerv. vertebrae	Penza Region	Campanian?	Polycotylidae indet.
Rhinosauriscus (*Rhinosaurus*) *jasykowii* (Fischer von Waldheim, 1847)	Original lost	skull	Ul'yanovsk Region?	Tatarian	Seymouriidae [see Rozhdestvenskii, 1973]
Scanisaurus (*Cimoliasaurus*) *nazarowi* (Bogolyubov, 1911)	MGRI	post. cervical centrum	Orenburg Region	Senonian	provisionally retained [see Persson, 1959]
Spondylosaurus fahrenkohli Fischer von Waldheim, 1846	—	vertebra	Moscow Region	Volgian	Plesiosauria indet.
Spondylosaurus frearsi Fischer von Waldheim, 1845	—	cervical centrum	Moscow Region	Kimmeridgian	?*Pliosaurus brachyspondylus*
Strongylokrotaphus (*Peloneustes*) *irgisensis* (Novozhilov, 1948a)	PIN 426	partial skull/skel.	Saratov Region	Volgian	*Pliosaurus irgisensis* [see Halstead, 1971]
Thaumatosaurus calloviensis Bogolyubov, 1911	MGRI	tooth	Moscow Region	Callovian	Pliosauridae indet. [but see Tarlo, 1960]
Thaumatosaurus mosquensis Kipriyanov, 1883	ZIN?	cervical vertebra	Moscow Region	Oxf.–Kimmeridgian	*Liopleurodon ?ferox*

Note:
Muraenosaurus kamensis and the ichthyosaur ?*Shastasaurus nordensis* inadvertently share the same catalogue number.

of '*Plesiosaurus*' suffer from the same problem (Storrs, 1996) while *Cimoliasaurus* is apparently a nondiagnosable plesiosaur (?elasmosaur) and 'waste-basket taxon' (Williston, 1903). Fischer von Waldheim's (1847) *Rhinosaurus*, described as a plesiosaur, was based upon a Permian anthracosaur skull, the origin of which was perhaps misinterpreted through confusion within the containing collection, and is now known as *Rhinosauriscus* (Kabanov, 1959; Rozhdestvenskii, 1973). Rarer plesiosaur remains are known from some of the other former Soviet republics but most, if not all, of these are also generically indeterminate.

Few species of Russian plesiosaur are known from material of adequate quality to justify their retention (Table 11.1). Only three of these potentially distinct species are unique to Russia. The three include the best Russian specimens and are known from partial skulls, although they have been described only in a preliminary fashion, and a comprehensive review of each is required.

PLIOSAURIDAE Seeley, 1874a

Liopleurodon Sauvage, 1873

Diagnosis. Large pliosaur distinguished from other forms by relatively short and straight-sided mandibular symphysis bearing 5–7 pairs of teeth; dorsal aspect of symphysis tapers anteriorly to blunt V. This diagnosis conforms to the concept of *Liopleurodon* in Tarlo (1960), although the genus is founded upon a single tooth (Sauvage, 1873) that may prove problematic.

Liopleurodon rossicus (Novozhilov, 1948a)

See Figure 11.1.

Holotype and locality. PIN 304, most of a skull and a partial pectrum (scapulae and coracoid), with perhaps a few other elements associated; Buinsk Mine oil shales, Ibresi District, right bank of Volga (Povolzh'e), Autonomous Republic of Chuvashia, Russia.

Horizon. Middle Volgian (*Dorsoplanites panderi* Zone).

Comments. Originally described as '*Pliosaurus*' *rossicus* Novozhilov, 1948a, this is a large, short-necked animal typical of the Pliosauridae. Most of what was once a complete skeleton was destroyed in 1938 during the process of mining the oil shales in which it was found, the remainder being saved only by chance. Halstead (1971) described a number of additional bones as belonging to the holotype, but inadequate collection management practices have seemingly allowed confusion of at least some of the bones of this specimen with those of '*Strongylokrotaphus*' *irgisensis* (discussed below). Ochev (pers. comm., 1995) insists that only the skull and pectrum of '*P.*' *rossicus* were recovered. Novozhilov (1948a, b) described only the skull, and later (Novozhilov, 1964) figured the pectrum. The short dorsal blade and anteroventral ramus of the scapula suggest that the animal was immature. Halstead (1971) considered '*P.*' *rossicus* to represent *Liopleurodon* largely on the basis of its short mandibular symphysis. It has, however, trihedral tooth cross-sections unlike the Oxfordian *Liopleurodon ferox*, but similar to *Pliosaurus*, a genus with a significantly longer symphysis. Tarlo's (1959) Kimmeridgian genus with trihedrally sectioned teeth and a short symphysis, *Stretosaurus*, was based upon incorrectly identified material and is hence invalid, much of the referred material probably belonging to *Liopleurodon* (Halstead, 1989). Pending new reviews of *Pliosaurus* and *Liopleurodon*, Halstead's interpretation of *L. rossicus* is accepted here. Points worth noting are that the bar between the naris and orbit is not as narrow as is suggested in the drawings in Novozhilov (1948a, 1964) and the naris itself is much smaller than shown. Furthermore, contrary to Novozhilov (1948a), there is no nasal bone or lacrimal.

Halstead (1971) also equated the enormous rostrum of '*Pliosaurus* cf. *P. grandis*' (PIN 2440/1), described by Rozhdestvenskii (1947) from the left Volga bank (Zavolzh'e), Ozink Mine, Saratov Province, *D. panderi* Zone, with *L. rossicus*. This specimen too, was discovered complete, but only the rostrum, the proximal end of a humerus, a phalanx, and some rib fragments were saved from the mining operations (Rozhdestvenskii, 1947). The complete hind limb noted by Halstead (1971) undoubtedly belongs to '*Strongylokrotaphus*' (PIN 426), as figured by Zhuravlev (1943) and Novozhilov (1964). The mandibular symphysis of PIN 2440/1 contains approximately six sharply trihedral teeth per ramus.

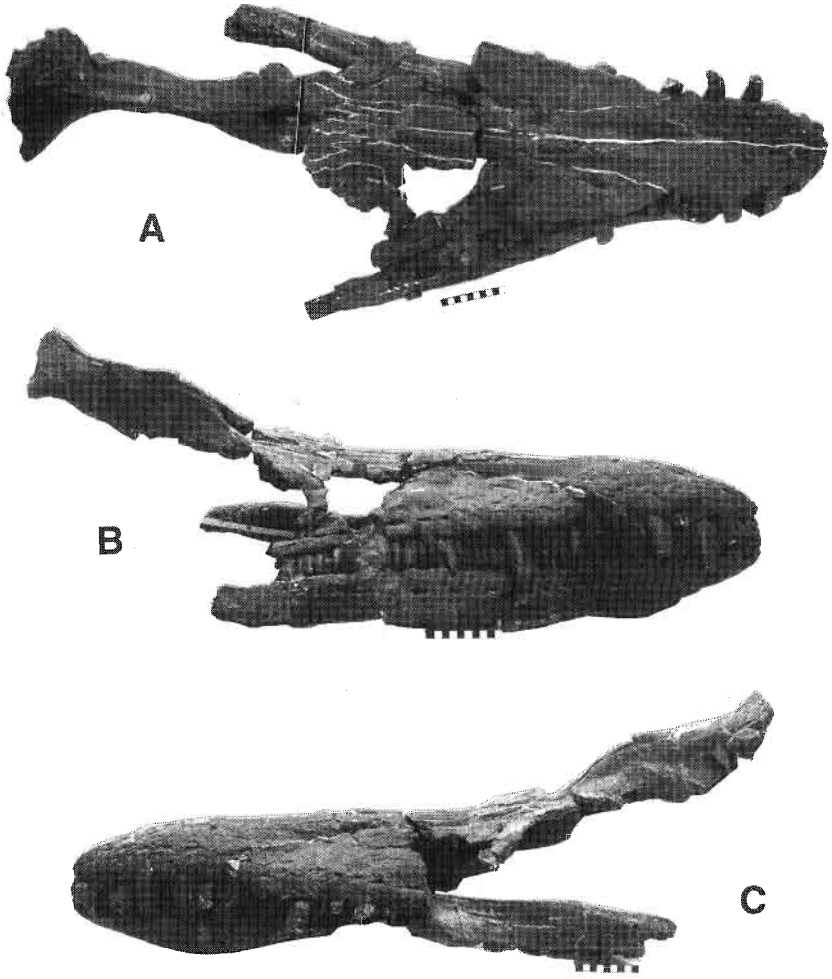

Figure 11.1. *Liopleurodon* (*Pliosaurus*) *rossicus* (Novozhilov, 1948a), PIN 304/1, from the middle Volgian oil shales of Buinsk Mine (*Dorsoplanites panderi* Zone), Ibresi District, Chuvashia. Skull and mandible in dorsal (A), right lateral (B), and left lateral (C) views. Scale bars, 100 mm. Compare with Novozhilov (1964).

Pliosaurus Owen, 1842

Diagnosis. Very large pliosaurid up to approximately 10 m, distinguished by long mandibular symphysis and trihedrally sectioned tooth crowns; approximately 11 pairs of caniniform teeth within symphysis; labial edges of mandibular symphysis approximately parallel.

Pliosaurus irgisensis (Novozhilov, 1948a)

See Figure 11.2.

Holotype and locality. PIN 426, a large partial skull, a partial vertebral column, and an articulated hind limb; oil shales of Savel'evsk Mine No. 1, near Gorny, about 35 km southwest of Pugachev, eastern Saratov Province, Russia.

Horizon. Savel'evsk oil shales, Volgian.

Comments. Most commonly known in Russian palaeontological circles as '*Strongylokrotaphus*' *irgisensis*, this fossil was found during mining operations in 1933 (Zhuravlev, 1941, 1943; Novozhilov, 1948a, 1964). The

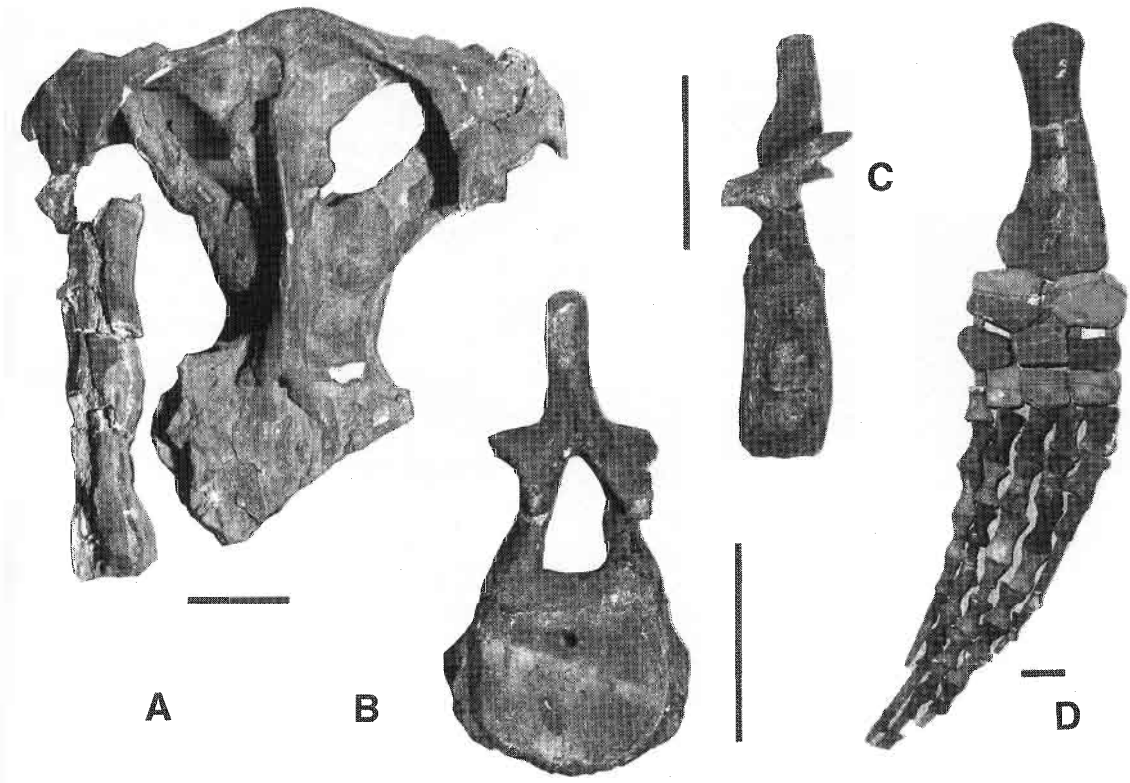

Figure 11.2. *Pliosaurus* (*Strongylokrotaphus*) *irgisensis* (Novozhilov, 1948a), PIN 426, from the Volgian oil shales of Savel'evsk Mine No. 1, near Gornyi, Pugachev District, Saratov Region. A, Skull roof, occiput, and right mandibular ramus in dorsal aspect (posterior at top). B, C, Anterior cervical vertebra in anterior and left lateral views, respectively. D, Right hind limb. Scale bars, 100 mm. Compare with Novozhilov (1964).

skeleton, as formerly exhibited in both the Pugachev Museum and PIN, was heavily restored and is less well preserved than appears in previously published photographs (Zhuravlev, 1941, 1943). All elements are now greatly affected by pyrite decay and the skull and mandible, in particular, are nearing destruction unless emergency conservation measures are soon employed, an unlikely scenario under present constraints.

Tarlo (1960) equated this taxon with *Pliosaurus*, noting that Novozhilov's (1948a) original assignment of this very large specimen to the relatively small *Peloneustes* was seemingly only on the basis of its elongated rostrum (of which only the extreme anterior tip, found in place, is preserved), and a misunderstanding of the characters of *Pliosaurus*. Indeed, *contra* Novozhilov (1964), there appears little to differentiate the species from *Pliosaurus*, and his creation of a unique genus (*Stongylokrotaphus*) appears unjustified.

The cervical centra of *Pliosaurus irgisensis* are large and blocky, but very short, as in *Pliosaurus*, and their ribs are distinctly double-headed as is typical for pliosaurids. Novozhilov's (1964) placement of this species in the Polycotylidae (= 'Trinacromeriidae') is entirely inappropriate. The figures in Novozhilov (1948a, 1964) are misleading; the ovate 'fenestrae' seen lateral to the posterior ends of the parietal crest represent an oblique dorsal view through the distorted posttemporal fenestrae. The posterior interpterygoid vacuities are not visible dorsally. The apparent 'foramina' in the occiput of Novozhilov's (1964) figure represent the

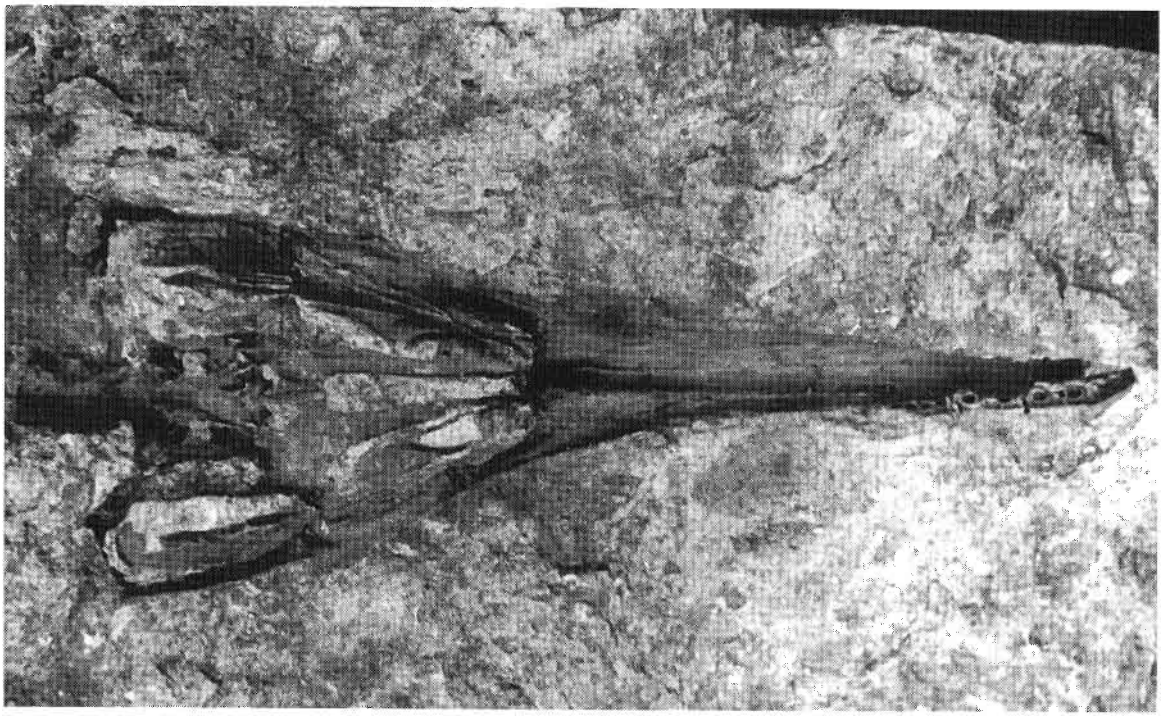

Figure 11.3. *Georgiasaurus* (*Georgia*) *penzensis* (Ochev, 1976a), POKM 11658, from a building stone quarry in Santonian rocks at Zatolokino, Bekovo District, Penza Region. Natural mould of braincase, dorsal surface of palate, and rostrum. Total length of skull approximately 800 mm. Compare with Ochev (1976a).

splayed halves of the crushed foramen magnum with the exoccipitals forced laterally. There is no lacrimal preserved. Indeed, if once present, the orbits and anterior rami of the squamosals are now lost. Neither is Novozhilov's (1964) figure of the right hind limb entirely accurate, as comparison with Figure 11.2 indicates.

The specimen has been cited as one of the few known pliosaurs with gut contents, i.e. associated cephalopod hooklets (Zhuravlev, 1943; Gekker and Gekker, 1955). Zhuravlev (1943) also notes the association of an entire fish, shark teeth, and sand or gravel. Surely the shark teeth are the result of scavenging of the carcass by these animals, but the current state of conservation of this fossil reptile prevents any additional comment. Apparently, none of the associated remains has been preserved in the collections.

POLYCOTYLIDAE Williston, 1908

Georgiasaurus Ochev, 1977

See Figure 11.3.

Diagnosis. Relatively large polycotylid pliosaur distinguished by its size (4–5 m) and relatively elongate rostrum; details of palate and braincase noted by Ochev (1976a) may also be significant.

Georgiasaurus penzensis (Ochev, 1976a)

Holotype and locality. POKM 11658, the natural moulds of a skull and partial skeleton from a building stone quarry in the Penza Region, Russia.

Horizon. Upper Cretaceous (Santonian).

Comments. Georgiasaurus Ochev, 1977 replaces the preoccupied *Georgia* Ochev, 1976a. The snout of *Georgiasaurus penzensis* is narrow and elongate and the cervical ribs are single-headed as in other polycotyl-

Russia, but *Thoracosaurus* has been described from Maastrichtian marine rocks of the Inkerman Mines of the Crimea, near Sevastopol' (Borisyak, 1913; Ryabinin, 1946b), and Efimov and Chkhikvadze (1987) note a possible Maastrichtian thoracosaur from the Crimean village of Skalistoe. The remains described by Borisyak (1913) as *T. macrorhynchus* include a well preserved skull that Steel (1973) has assigned to *T. scanicus*, and Efimov (1988) to *T. borissiaki* (see Chapter 20, this volume). A possible, fragmentary thoracosaur has also come from the marine Cretaceous of Malaya Serdoba in the Penza Region (pers. comm., L.S. Glikman).

ANAPSIDA Williston, 1917

TESTUDINES Linnaeus, 1758

Comments. Marine turtles are rare and very poorly known in Russia and are only little more frequently seen in the rocks of the Soviet Union's former Asian republics. All known occurrences are Cretaceous. In Russia, the few remains of sea turtles are largely from the Upper Cretaceous sediments of the Lower Volga Basin (Campanian to Maastrichtian), such as Malaya Serdoba in the Penza Region. However, fragmentary chelosphargine protostegids are reported from the Aptian? to Cenomanian Lebedinsk and Soilensk quarries of the Belgorod Region (Nesov, 1985).

All the Asian localities represent abnormal marine conditions (deltaic to lagoonal), and have produced reports almost exclusively of toxochelyids. *Kirgizemys exaratus* Nesov and Khozatskii, 1978 is from the Albian Alamyshak Svita of Kirgizstan (ZIN T/F 491), and *Anatolemys maximus* (PIN 2398/501) and *A. oxensis* (ZIN RNT S 74–1) were described by Khozatskii and Nesov (1979) from the Turonian– Santonian of West Fergana and the upper part of the Khodzhakul Svita (Cenomanian) of Karakalpakia, respectively. *Oxemys gutta* Nesov, 1977 is from the Turonian (Beshtubinskaya Svita) of Lake Khodzhakul, Karakalpakia (TsGM 2/11478). The Kzyl-Kum Region of Karakalpakia and Uzbekistan has also produced remains of *Anatolemys* and *Kirgizemys* in Albian? to Turonian rocks (Nesov and Krasovskaya, 1984). A single desmatochelyid is known from the Santonian–Campanian of Uzbekistan (Glikman *et al.*, 1987).

Summary

Although the fossil record of Russian marine reptiles is currently poor, with very few well preserved specimens in existence, many fragmentary remains have been found. It is obvious that the vast territories of Russia and of her former satellite republics represent unrealized potential for the future discovery of important specimens. Fossil localities are concentrated in the central and southern parts of the Russian Platform (Jurassic and Cretaceous) and in the Asiatic former republics (Cretaceous), and reflect the palaeobiogeography of the times (Rozhdestvenskii, 1973). As now known, the marine reptiles of Russia comprise four to six families of plesiosaur (Pliosauridae, Elasmosauridae, Polycotylidae, Pistosauridae, ?Cryptoclididae, ?Cimoliasauridae), four families of ichthyosaur (Mixosauridae, Shastasauridae, Ichthyosauridae, Leptopterygiidae), perhaps two or three sub-families of Mosasauridae (Mosasaurinae, Plioplatecarpinae, ?Tylosaurinae), three families of turtle (Protostegidae, Toxochelyidae, Desmatocheyidae) and three families of crocodilian (Metriorhynchidae, Teleosauridae, Crocodylidae – Thoracosaurinae). A single snake (Simoliophidae) is known from lagoonal deposits.

Although few named Russian species may be regarded as valid, a picture of marine reptile stratigraphic distribution is emerging which correlates well with, and complements that suggested elsewhere. Plesiosaurs and ichthyosaurs are common in the Upper Jurassic and Lower Cretaceous. Plesiosaurs and mosasaurs dominate the Upper Cretaceous after the apparent extinction of ichthyosaurs in the Cenomanian. By far the greatest number of marine reptile remains have been recovered from Upper Jurassic rocks, followed by deposits of Senonian age.

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