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The First Plesiosaur from the Primorye Krai

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Mesozoic marine reptiles are common in European Russia but are extremely scarce in the Far East [1]. Plesiosaurs have been recorded in the Lower Cretaceous of Sakhalin [2]. A phalanx of a plesiosaur described as *Elasmosaurus* (?) *sachalinensis* Riabinin, 1915 was found by N.N. Tikhonovich in 1909 in the Lower Senonian (Coniacian–Santonian, 89–83 Ma) of Sakhalin [3, 4]. This specimen is impossible to identify more closely than Plesiosauria indet. [1]. The teeth and vertebrae of the long-necked plesiosaurs Elasmosauridae were found by L.A. Nessov in 1988 in the upper strata of the Koryak Formation (Upper Maastrichtian, 68–65 Ma) on the Pacific coast of the Chukotka Peninsula [4]. In the areas bordering on Russia (Korea, China, and Japan), plesiosaurs have not been recorded. In 2000, V.K. Popov discovered the fourth plesiosaur occurrence in the Far East; it was found during the geological survey in southern Primorye in marine deposits of the Kangauz Formation of the Upper Albion (103–98 Ma) on the right slope of the Sukhodol River (Kangauz), opposite the village of Novonezhino (43°12' N, 132°35' E), Primorye krai (Fig. 1). This is a caudal vertebra of a plesiosaur (specimen ZIN PH, no. 1/48, Paleoherpological collection of the Zoological Institute of the Russian Academy of Sciences). The bone beds are composed of dark greenish gray fine- and medium-grained tuffaceous sandstones, with carbonate material, containing abundant gastropod and bivalve shells, plant detritus, and rare fragments of reptile bones. These sandstones are interbedded with siltstones containing plant remains. The presence of fragmentary reptile bones in these beds (Cape Sedlovodnyi) was first established in an unpublished report by N.A. Belyaevskii and V.D. Prinada (1948). They found a relatively large fragment of a reptile bone (at least 45 cm long) in coarse-grained (gravellike) sandstones forming interbeds in massive dense medium-grained sandstones in the northern extremity of the Cape Sedlovodnyi (Khangang). This was the first finding of reptile bones in the Nikanskaya Beds of southern Primorye. Subsequently,

in the explanatory note to the geological map of Primorye, scale 1 : 500000 [5, p. 123], it was indicated that "...in siltstone deposits considered, vertebrates are represented by unidentifiable fish remains (scale and gill covers) and an imprint of a vertebral column, while sandstone deposits have yielded large fragments of reptile bones." Siltstones of these strata yielded conchost-racans, ostracodes, freshwater gastropods and bivalves, and plant imprints. From 2001 to 2003, V.S. Markevich, E.V. Bugdaeva (Institute of Biology and Soil Sciences, Far East Division, Russian Academy of Sciences), and Yu.L. Bolotskii (AMURKNII) collected fish imprints and unidentifiable fragments of reptile bones in outcrops on capes Palets and Sedlovodnyi.

The strata described extend in northeast direction from Cape Sedlovodnyi (Andreev Bay) on the eastern coast of Ussuriiskii Gulf to the village of Novonezhino (Sukhodol River Basin) over a distance of more than 20 km. Belyaevskii and Prinada (report, 1948) described bone-bearing beds in the green siltstone strata dated Early Cretaceous. Subsequently, these deposits were assigned to the Cenomanian–Santonian (97–83 Ma) [5]. As a result of geological survey (1 : 200000), these strata were later assigned to the Frenstevka Formation dated Albion–Cenomanian (112–93 Ma) [6]. At present, these strata are recognized as the separate Kangauz Formation dated Middle–Late Albion (105–98 Ma) [7]. The Kangauz Formation is composed of siltstones, sandstones, tuffites, and conglomerates and occurs on the eastern coast of Ussuriiskii Gulf.

The vertebra (Fig. 2) is platycelous, with circular articular facets. The ventral side of the vertebral centrum is 23.5 mm long. The greatest height of the vertebra, including the neural spine, is 48 mm. The posterior articular facet of the vertebral centrum is slightly oblique. Its ventral margin, along with the articular facets for the haemal arch, are broken off. The transverse process is stout, its base occupies the ventral area of the neural arch and the dorsal area of the vertebral centrum. The distal end of the transverse process expands abruptly dorsoventrally. The transverse process is 39 mm long. The vertebral foramen is relatively small. The prezygapophyses are broken off. The postzygapophyses are shifted close to one another, located near the midheight of the neural arch. Anteroposteriorly, the

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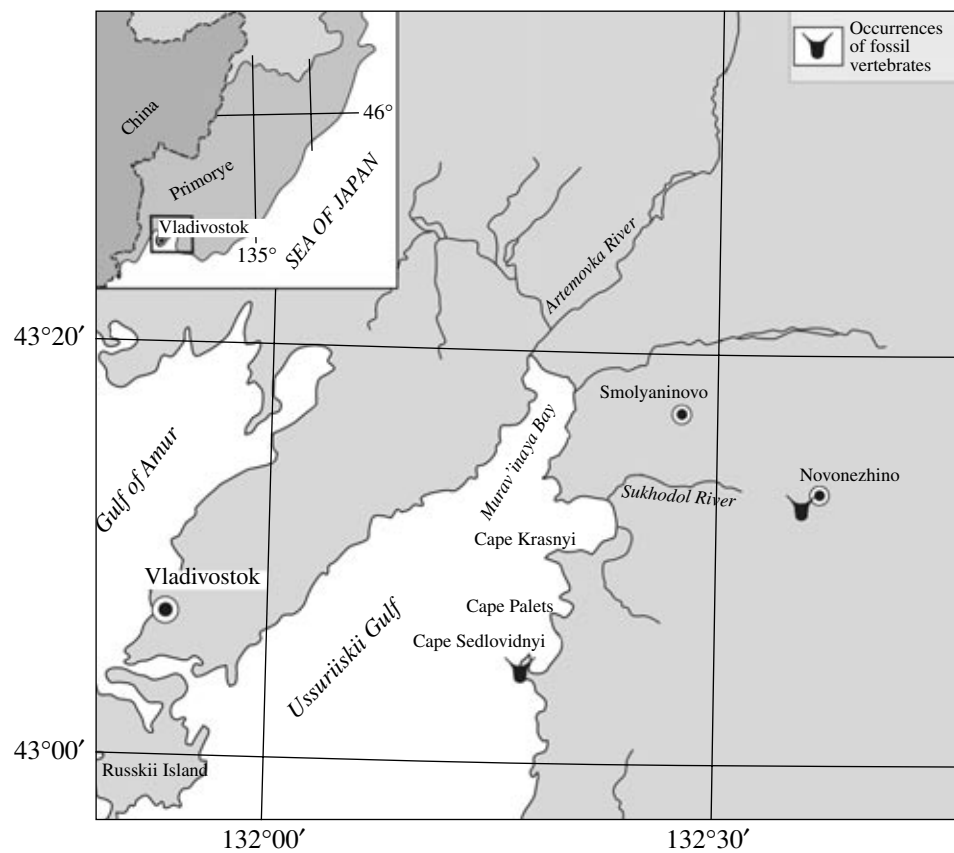


Fig. 1. Occurrences of reptile bones (Cape Sedlovnyi) and the plesiosaur described (the village of Novonezhino) in the Primorye krai.

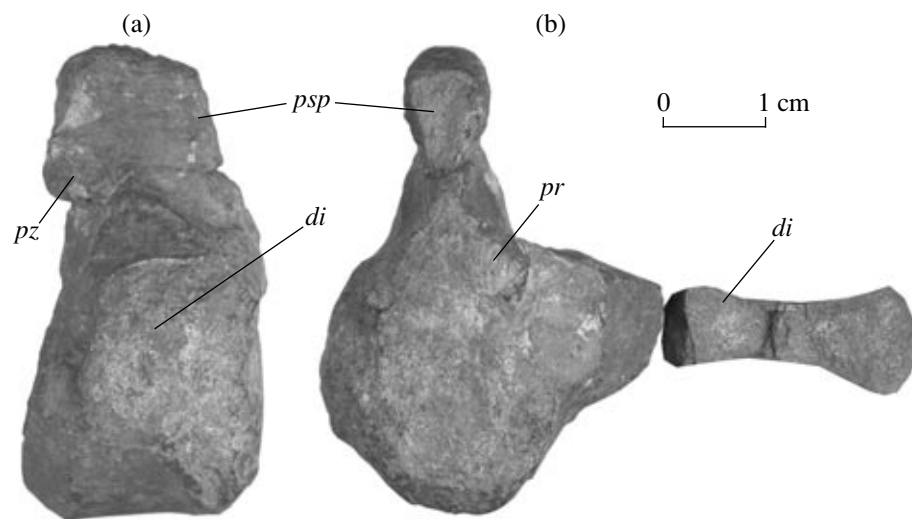


Fig. 2. A caudal vertebra of Plesiosauria indet. (specimen ZIN PH, no. 1/48): (a) side lateral and (b) frontal views; the village of Novonezhino, Primorye; Kangauz Formation, Upper Albian. The right transverse process is absent; the left transverse process is damaged, its position is reconstructed on the basis of an imprint in the host rock. Designations: (*di*) transverse process; (*pr*) prezygapophysis; (*psp*) neural spine; and (*pz*) postzygapophysis.

neural spine is approximately as long as the vertebral centrum and expands laterally at the dorsal end. The

dorsal side of the neural spine has a rough attachment area for the intervertebral ligament.

Specimen ZIN PH, no. 1/48 is assigned with reasonable confidence to Plesiosauria based on the combination of the following characters: the vertebral centrum is platyclous, the transverse processes are dorsoventrally expanded at the end, and the base of the transverse process occupies approximately equal areas on the neural arch and the vertebral centrum [8, 9, etc.]. It is impossible to identify this specimen more precisely.

The beds of the Kangauz Formation correspond to the facies of a brackish-water gulf and freshwater lakes, with an admixture of volcanic rocks. The co-occurrence of specimen ZIN PH, no. 1/48 and plant detritus suggests that the sedimentation site was situated close to the shore. Plesiosaurs were common in the coastal area of the Mesozoic seas and could swim to the brackish-water estuaries or even river mouths.

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