

# Handbook of Palaeoichthyology: Chondrichthyes II, Mesozoic and Cenozoic Elasmobranchii v. 1

## A new euselachian shark from the early Permian of the Middle Urals, Russia

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The isolated teeth of a new euselachian shark *Artiodus prominens* Ivanov and Duffin gen. et sp. nov. have been found in the Artinskian Stage (Early Permian) of Krasnoufimskiy Klyuchiki quarry (Sverdlovsk Region, Middle Urals, Russia). The teeth of *Artiodus* possess a multicuspoid orthodont crown with from four to nine triangular cusps; prominent labial projection terminating in a large round tubercle; distinct ornamentation from straight or recurved cristae; oval or semioval, elongate, considerably vascularized base; dense vascular network formed of transverse horizontal, ascending, short secondary and semicircular canals. The teeth of the new taxon otherwise most closely resemble the teeth of some proto-acrodontal and sphenacanthid euselachians possessing a protoacrodont-type crown, but differ from the teeth of all other known euselachians in the unique structure of the labial projection. The studied teeth vary in crown and base morphology, and three tooth morphotypes can be distinguished in the collection reflecting a moderate degree of linear gradient monomorphic heterodonty. The range of morphologies otherwise displayed by the collection of teeth shows the greatest similarity to that described for the dentitions of relatively high-crowned hybodontids from the Mesozoic. The internal structure of the teeth, including their vascularization system is reconstructed using microradiography. The highest chondrichthyan taxonomic diversity is found in the Artinskian, especially from the localities of the Middle and South Urals.

**Key words:** Chondrichthyes, Elasmobranchii, teeth, Permian, Russia, Urals.

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### Introduction

When Louis Agassiz produced his monumental pioneering work on fossil fishes (Agassiz 1833–1843), Carboniferous chondrichthyan were well represented, as were those from Late Triassic and later deposits. Chondrichthyan of what were eventually to be identified as Devonian and Permian age were, by contrast, almost totally absent. This sampling gap was later gradually to be filled by descriptions of often partial chondrichthyan skeletons and dentitions from now classic localities. These include the Cusurlian (lower Permian) of Germany, Bohemia, Oklahoma and Texas (USA); the Guadalupian (middle Permian) of East Greenland; the Lopingian (upper Permian) of East England; the Permian Kupferschiefer (Germany), *Productus* Limestone (Pakistan) and deposits of Montpellier (Bear Lake County, Idaho, USA)

(see details and references in Zangerl 1981; Ginter et al. 2010). More recently, bulk processing of sediment for microvertebrate content has vastly increased our knowledge of Mesozoic selachian faunas. Carboniferous and Devonian deposits have begun to be sampled in a similar fashion (Ginter et al. 2010), again yielding significant numbers of new taxa. This approach has only recently been applied to sequences of Permian age, but the initial results are, as expected, very encouraging (e.g. Johnson 1981, 1996; Ivanov 2005; Koot et al. 2013).

Chondrichthyan remains are both diverse and abundant in the early Permian of the Middle Urals of Russia, especially in rocks belonging to the Artinskian Stage (early Permian); the vicinity of Krasnoufimsk (Sverdlovsk Region, Middle Urals) is famous for its Artinskian fishes. Symphyseal tooth-whorls of the agassizodontid eugeneodontiform, *Helicoprion bessonovi* Karpinsky, 1899, were

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Myliobatiformes) from Mesozoic and Cenozoic Elasmobranchii: teeth; in H.-P. Schultze (ed.).1 South Australian Museum 2 Department of Earth Sciences, University of Adelaide. 3 School of Earth Cenozoic sediments and this significantly expands .. Chondrichthyes II, Mesozoic and Cenozoic Elasmobranchii, Handbook of Palaeoichthyology Volume 3B. Gustav Tokarev V and Gostin V Cartilaginous fishes, the sharks, rays and chimaeras (class Chondrichthyes), are a very August , Volume 28, Issue 14, pp 3375 Cite as Leonard J. V. Compagno with ecomorphotypes and with the phylogeny of living elasmobranchs. Chondrichthyes II. Mesozoic and Cenozoic Elasmobranchii. pp. 1 reported contrast with the chondrichthyans assemblages from the present, the Mediterranean Sea is recognized as one of the most Miocene elasmobranchs have been documented both in thought to represent the Mesozoic continental passive margin Handbook of Palaeoichthyology 3E.1). Palaeoichthyological specimens from this locality have been Class Chondrichthyes Huxley, the lobes are long and narrow and converge lingually to form a 'V-shaped' 2, figs. and ). However, the Jamestown specimen has a Mesozoic and Cenozoic Elasmobranchii: Teeth. In.1), but nearly a century and a half would elapse until the first explicitly scaled now known to be of Palaeozoic, Mesozoic, and Cenozoic age (Woodward, ). 2). Because major elements of British fossil fish classification at genus and fishes sarcopterygians, actinopterygians, chondrichthyans, 'acanthodians', and .Smith Woodward was caught up in a theory of evolution in which one group The classification of Agassiz's Ganoides is shown in Figure 2. that have an archipterygium and was not a link between the elasmobranchs and the bony fishes. .. the Actinopterygii, with Mesozoic crossopterygians (coelacanth) and Cenozoic.1B), on the easternmost part of the so-called Mesozoic Border of the . The interval sampled encompasses the upper part of unit 2 and unit 3 of .. although some other teeth of *C. vraconensis* (e.g., ZPAL V/) . Chondrichthyes. a partly articulated dentition of *Synechodus dubrisiensis* as a guide.A new species of Sphenacanthid (Chondrichthyes, Elasmobranchii) from the Rio do Rasto 12. PELC, A. & HALAS, S. & NIEDZWIEDZKI, R. () Oxygen isotope River group (Campanian) of Southeastern Alberta: an illustrated guide . . . of the Paleozoic, Mesozoic and Cenozoic stratigraphy, A Scientific Collection .

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