

A new species of the antiarch *Microbrachius* from the Middle Devonian (Givetian) of Belarus

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Abstract. A new antiarch species *Microbrachius kedoae* n. sp. is described from the Middle Devonian (Givetian) of Belarus. The species is based on isolated dermal plates recovered from a borehole near the village of Gavrilchitsy about 25 km southwest of the city of Soligorsk. *Microbrachius kedoae* compares well to the type species *Microbrachius dicki* from Scotland, but differs from this and all other *Microbrachius* species in the mixilateral plate being overlapped by the anterior median dorsal plate. The presence of *Microbrachius* species of the same age in Scotland and Belarus strengthens the argument of faunal connections between the two areas in the Middle Devonian.

Key words: Antiarchi, Middle Devonian, Belarus, Estonia, Scotland, morphology.

INTRODUCTION

The original draft manuscript of this paper was written in the late 1980s by Elga Mark-Kurik. In their original form, two species of *Microbrachius* were erected by Mark-Kurik, one from Estonia and one from Belarus. At the time of the original draft only two species were known, the type species *Microbrachius dicki* Traquair, 1888 and a Chinese species *Microbrachius sinensis* Pan, 1984. For various reasons the manuscript was put on hold whilst Mark-Kurik pursued other projects. This article deals with one half of the original manuscript (the other half will be dealt with at a later date) and describes the Belarusian species *Microbrachius kedoae* n. sp. This species comes from a core from a single locality in southern Belarus (Fig 1).

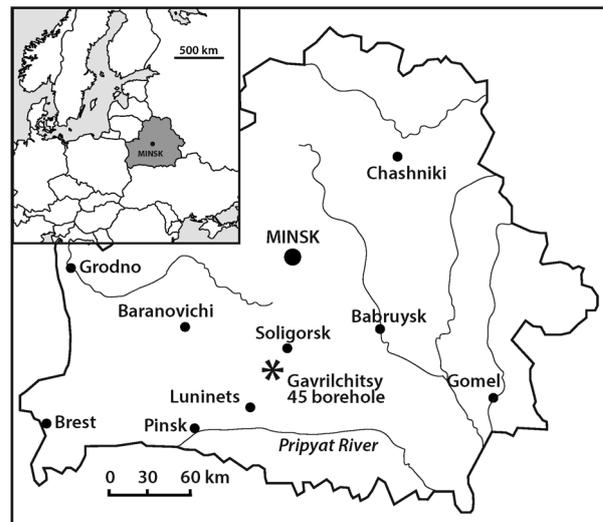


Fig. 1. Locality map, modified from Plax (2008a, fig. 1).

HISTORY OF RESEARCH OF MICROBRACHIUS

Microbrachius is a small antiarch genus first discovered in the Middle Devonian (Givetian) Orcadian Basin of Scotland. Specimens of *Microbrachius* were first mentioned as a possible, new, small species of *Pterichthys* (now known as *Pterichthyodes*) by Peach (1868). He expressed that if the specimens did turn out to be new,

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they should be named after his friend, the fossil collector Robert Dick. It took over 20 years before Traquair (1888) published a short description (without figures) of the type species *Microbrachius dicki*. Later, Traquair (1904; the relevant part published in Traquair 1894–1914) figured some specimens and provided a fuller description of the species. Watson (1935) provided the first restoration

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in a very brief description. The first detailed description, including the individual dermal plates, was made by Hemmings (1978).

Two Chinese species have also been described. *Microbrachius sinensis* is dated as Eifelian, Middle Devonian and *Microbrachius chuandongensis* Wang & Zhang, 1999 is dated as Emsian, Early Devonian (see the discussion for more comments on these species). There are also specimens of *Microbrachius* found at the Essi müür (alias Essi Farm) locality in Estonia (Long et al. 2015). This species is currently under detailed investigation by the authors and others and will not be alluded to in this paper. All the specimens described in this paper are housed in the Department of Geology, Tallinn University of Technology, Estonia (GIT).

PHYLOGENY

From the earliest descriptions of *Microbrachius* it was known that it was an antiarch although a more precise understanding of its phylogeny was not possible until the detailed description of the dermal armour was made by Hemmings (1978). Hemmings (1978) considered *Microbrachius* a bothriolepidoid belonging in its own family the Microbrachiidae Gross, 1965. This view was tested and confirmed by Lukševičs (2001, fig. 82) in a phylogenetic analysis modified after Young (1988). More recently, the phylogeny of *Microbrachius dicki* has come under close scrutiny due to the discovery of male claspers (Long et al. 2015). Long et al. (2015) described *Microbrachius* as a small bothriolepid antiarch. Qiao et al. (2016) placed *Microbrachius* next to *Bothriolepis* in their cladistic analysis, thereby confirming the above opinions.

SYSTEMATIC PALAEOLOGY

Suborder BOTHRIOLEPIDOIDEI Miles, 1968
 Family MICROBRACHIDAE Gross, 1965
 Genus *Microbrachius* Traquair, 1888

Type species. *Microbrachius dicki* Traquair, 1888.

Diagnosis (by Hemmings 1978; altered). Antiarch of small size. Head-shield relatively large and broader than it is long, between 40% and 45% of total dorsal length of dermal armour; postpineal plate drawn into pronounced point towards orbital fenestra; postpineal plate in contact with lateral plate. Dorsal wall of trunk-armour embayed anteriorly to accommodate head; tergal angle situated far forward; anterior median dorsal plate with breadth/length index between 100 and 128; pectoral articulation subcephalic; funnel pit of processes brachialis in anterior

ventro-lateral very small; pars pedalis under angle to longitudinal body axis. Pectoral appendage with well-developed lateral and prominent mesial spines or enlarged denticles on both proximal and distal segments. Ornamentation of a combination of tuberculated ridges and tubercles.

Species composition. *Microbrachius dicki* Traquair, 1888, *M. sinensis* Pan, 1984, *M. chuandongensis* Wang & Zhang, 1999 and *M. kedoae* sp. n.

Microbrachius kedoae sp. n.

Etymology of name. After the late Belarus palynologist Dr Galina Kedo, Minsk.

Holotype. GIT 767-9, a right mixilateral plate housed at the Department of Geology, Tallinn University of Technology, Estonia.

Material. Left lateral plates preserved viscerally: GIT 767-2, GIT 767-3 and GIT 767-17. Right lateral plate preserved dorsally: GIT 767-11. Right paranuchal plate preserved dorsally: GIT 767-7. Anterior median dorsal plates preserved viscerally: GIT 767-4, GIT 767-5, GIT 767-6 and GIT 767-23. Posterior median dorsal plate preserved viscerally: GIT 767-8. Posterior median dorsal plate preserved dorsally: GIT 767-16. Left mixilateral plate preserved viscerally: GIT 767-9. Left mixilateral plate preserved dorsally: GIT 767-10. Right anterior ventro-lateral plates preserved viscerally: GIT 767-12 and GIT 767-14. Right posterior ventro-lateral plate preserved viscerally: GIT 767-1. Left posterior ventro-lateral plate preserved viscerally: GIT 767-18. Proximal pectoral appendages: GIT 767-19 and GIT 767-20. Distal pectoral appendage: GIT 767-24. Fragment of an anterior ventro-lateral plate: GIT 767-15. Fragment of bone: GIT 767-25. Figure 2 indicates the known plates and their position on the body.

Occurrence. Type locality only: Gavrilchitsy 45 borehole near the village of Gavrilchitsy, southwest of Soligorsk in southern Belarus. Material collected at a depth of 225.25–228.95 m in the Moroch Beds of the Polotsk Regional Stage, Givetian, Middle Devonian.

Diagnosis. Breadth/length index of the anterior median dorsal plate 120–128; lateral plate very long and narrow; median dorsal plate with wide lateral angles; mixilateral plate overlapped by the anterior median dorsal plate; ornamentation of widely spaced linear ridges with finely tuberculated areas between them.

Description

Head plates. The lateral plate is fairly long and thin, being broader at the anterior end. There is a fair amount

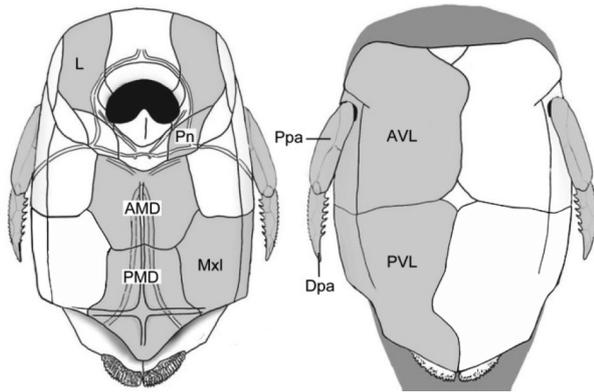


Fig. 2. *Microbrachius dicki* restoration (modified from Long et al. 2015, fig. 3a, b) with light grey shaded areas to indicate the known plates of *Microbrachius kedoae*. Abbreviations: AMD, anterior median dorsal plate; AVL, anterior ventro-lateral plate; Dpa, distal pectoral appendage; L, lateral plate; MxL, mixilateral plate; PMD, posterior median dorsal plate; Pn, paranuchal plate; Ppa, proximal pectoral appendage; PVL, posterior ventro-lateral plate.

of variation in the overall morphology of the plate and the length/breadth ratio varies between about two and three times as long. The mesial edge curves strongly round the orbital fenestra and this is further reflected in the convex lateral edge. The anterior edge is convex unless worn. GIT 767-11 (Fig. 3A, B) is the only specimen known preserved dorsally. A right L plate is somewhat worn, but the ornamentation is clear, consisting of tubercles and ridges, with the ridges being more prominent posteriorly and the tubercles more prominent anteriorly. There are also three known viscerally preserved

specimens, all left L plates. GIT 767-2 (Fig. 3C, D), although damaged in places, is the most informative specimen and has a distinctive rod-like crenulated anterior margin. The mesial margin runs from the preorbital angle to the postorbital angle and is hollowed dorsally by the lateropremesial depression. This depression develops lateral into the lateropremesial ridge of the head-shield. Lateral to this ridge a premedian ridge is weakly developed. The antero-lateral angle of the otico-occipital depression of the head-shield is developed as a tapering hollow entering the posterior edge.

GIT 767-7 (Fig. 4) is a very small paranuchal plate preserved in dorsal view. The mesial length of the plate is longer than the lateral length. A very faint groove of the principle section of the infraorbital sensory line (ifc1) is visible. Ornamentation consists of some few tubercles with stellated bases and a number of pits. The specimen belongs probably to a juvenile.

Trunk plates. The anterior median dorsal plate is only known in visceral view (Fig. 5). The plate is short, broad and ovoid in shape, being wider than long with a breadth/length index of 120 to 128 (compared with a breadth/length index of 100 to 120 for *Microbrachius dicki* and around 100 for *Microbrachius sinensis* and *Microbrachius chuandongensis*). The posterior margin is straight or slightly convex, with a pronounced posterior median process. A fairly deep, anterior ventral pit occurs on a north/south axis in the middle of the plate. There are well developed lateral corners at the points the plate overlaps the anterior dorso-lateral and the mixilateral plates. The lateral corners are level with the posterior end of the anterior ventral pit or just posterior of it. The areas where the plate overlaps the mixilateral plates

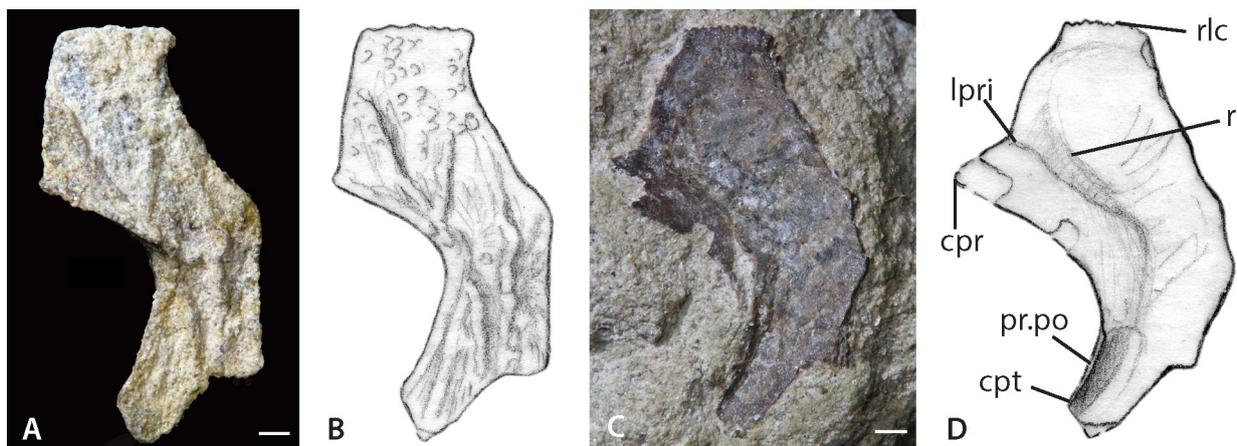


Fig. 3. *Microbrachius kedoae* from the Gavrilchitsy 45 borehole. **A, B,** GIT 767-11, a right lateral plate in dorsal view. **C, D,** GIT 767-2, a left lateral plate in visceral view. Scale bars = 1 mm. Abbreviations: cpr, preorbital angle; cpt, postorbital angle; lpri, lateropremesial ridge of the head-shield; pr.po, antero-lateral corner of otico-occipital depression; r, premedian ridge; rlc, rod-like crenulated anterior margin.

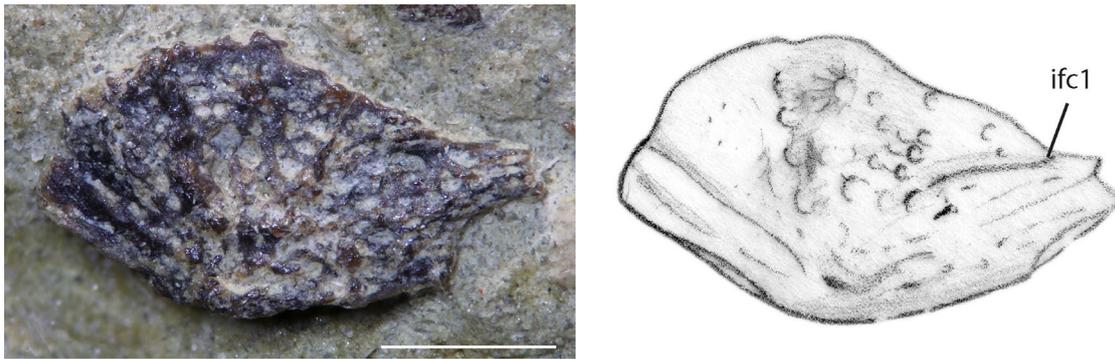


Fig. 4. *Microbrachius kedoae* from the Gavrilchitsy 45 borehole. GIT 767-7, a right paranuchal plate in dorsal view. Scale bar = 1 mm. Abbreviation: ifc1, principle section of infraorbital sensory line.

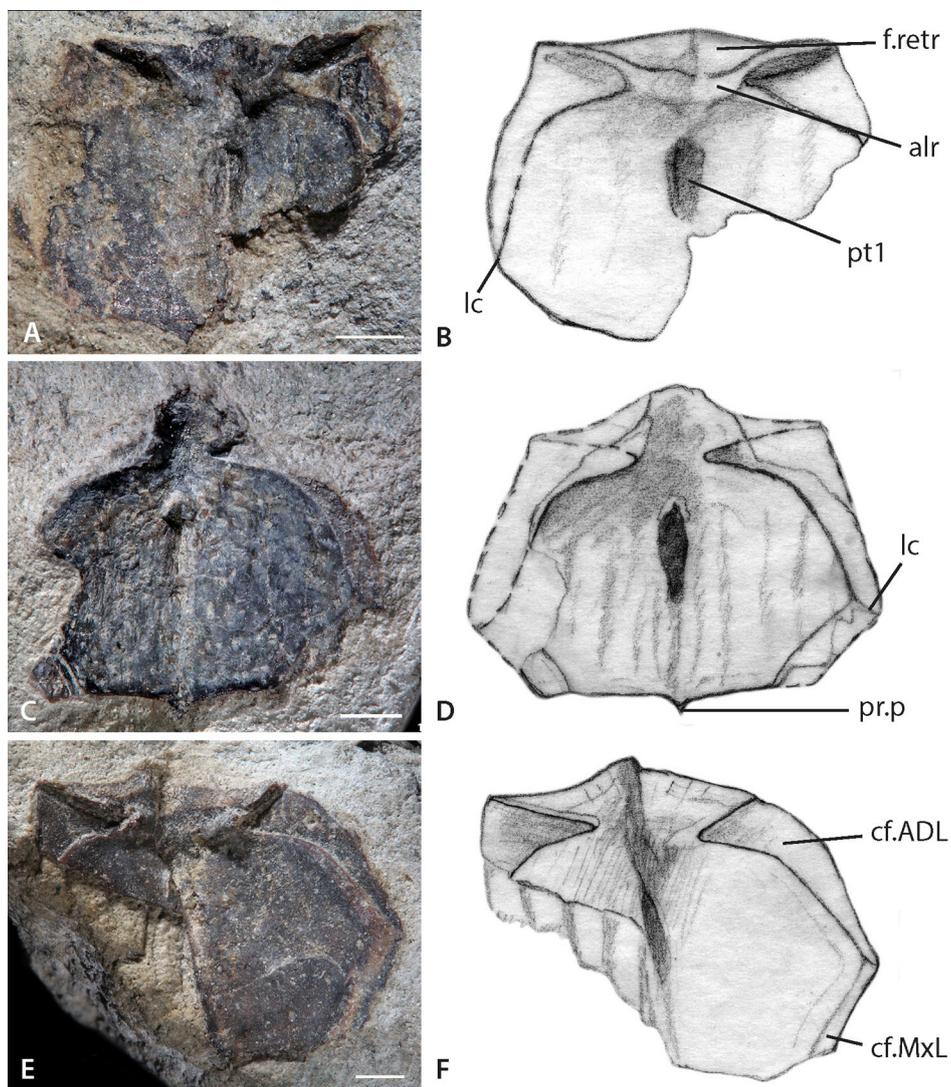


Fig. 5. *Microbrachius kedoae* specimens from the Gavrilchitsy 45 borehole. Anterior median dorsal plates in visceral view. A, B, GIT 767-4. C, D, GIT 767-5. E, F, GIT 767-6. Scale bars = 1 mm. Abbreviations: ADL, anterior dorso-lateral plate; AMD, anterior median dorsal plate; MxL, mixilateral plate; alr, postlevator thickening of AMD; cf.ADL, area overlapping ADL; cf.MxL, area overlapping MxL; f.retr, levator fossa of AMD; lc, lateral corner of AMD; pr.p, posterior median process of AMD; pt1, anterior ventral pit of dorsal wall of trunk armour.

are short and quite narrow. The areas where the plate overlaps the anterior dorso-lateral plates are of a similar width posteriorly but then curve strongly to form an extended indentation following the course of the postlevator thickening. This thickening forms a thin ridge that runs to lateral edges. Anterior of the postlevator thickening is the levator fossa.

The posterior median dorsal plate is known in dorsal and visceral views (Fig. 6). GIT 767-8 (Fig. 6A, B) is the only known viscally preserved specimen but only

the anterior end is preserved. The plate overlaps the anterior median dorsal plate at the anterior margin and overlaps the mixilateral plates at the lateral margins. The anterior margin has an anterior corner midline and is delimited from the lateral margin by distinct antero-lateral angles. Growth lines are also visible on this specimen. GIT 767-16 (Fig. 6C, D) is the only posterior median dorsal plate preserved dorsally, but it is from a very small individual, probably a juvenile. It is near complete, although missing some of the lateral edges

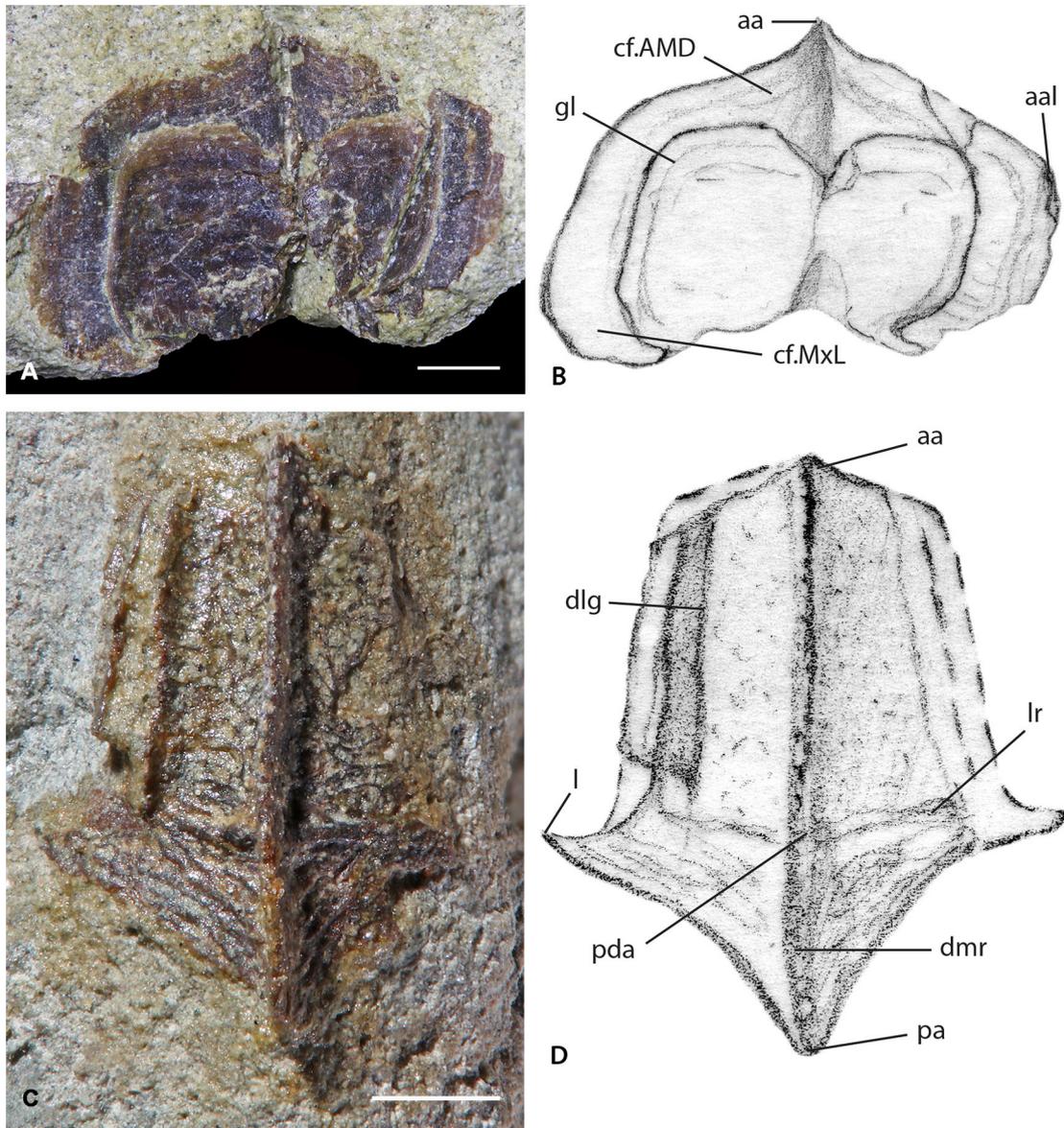


Fig. 6. *Microbrachius kedoae* from the Gavrilchitsy 45 borehole. Posterior median dorsal plates. **A, B**, GIT 767-8 in visceral view. **C, D**, GIT 767-16 in dorsal view. Scale bars = 1 mm. Abbreviations: AMD, anterior median dorsal plate; MxL, mixilateral plate; PMD, posterior median dorsal plate; aa, anterior angle of PMD; aal, anterior lateral angle of PMD; cf.AMD, area overlapping AMD; cf.MxL, area overlapping MxL; dlG, dorsal sensory line groove; dmr, dorsal median ridge; gl, growth line; l, lateral corner of PMD; lr, lateral ridge; pa, posterior corner; pda, posterior dorsal angle of trunk-armour.

which would suggest in life the plate was fairly short and broad, being broadest at the lateral corners, although the breadth/length index is uncertain. The lateral corners form distinct points around two thirds down the length of the plate but due to wear it is unclear if the very ends are preserved. The posterior border is broader than the anterior border. The dorsal median ridge formed of tubercles is very clear and reaches an apex at the posterior dorsal angle where it meets an indistinct lateral ridge. This lateral ridge is formed of tubercles that run anteriorly subparallel to the lateral corners, although as stated above, it is not clear if the true lateral corners are

preserved. Normally it would be expected for this lateral ridge to run to the lateral corners. The anterior angle and the posterior angle are connected by the dorsal median ridge. Two posterior–anterior ridges running parallel to the dorsal median ridge are present on the left side, the right side being worn away. A wide sensory groove runs anterior of these ridges but it is not clear if it terminates at the posterior margin of the plate as in the type species.

The mixilateral is in general short and broad with an extended posterior border. Two right mixilateral plates are known. GIT 767-9 (Fig. 7A, B) is preserved viscerally, but as most of the bone is no longer present,

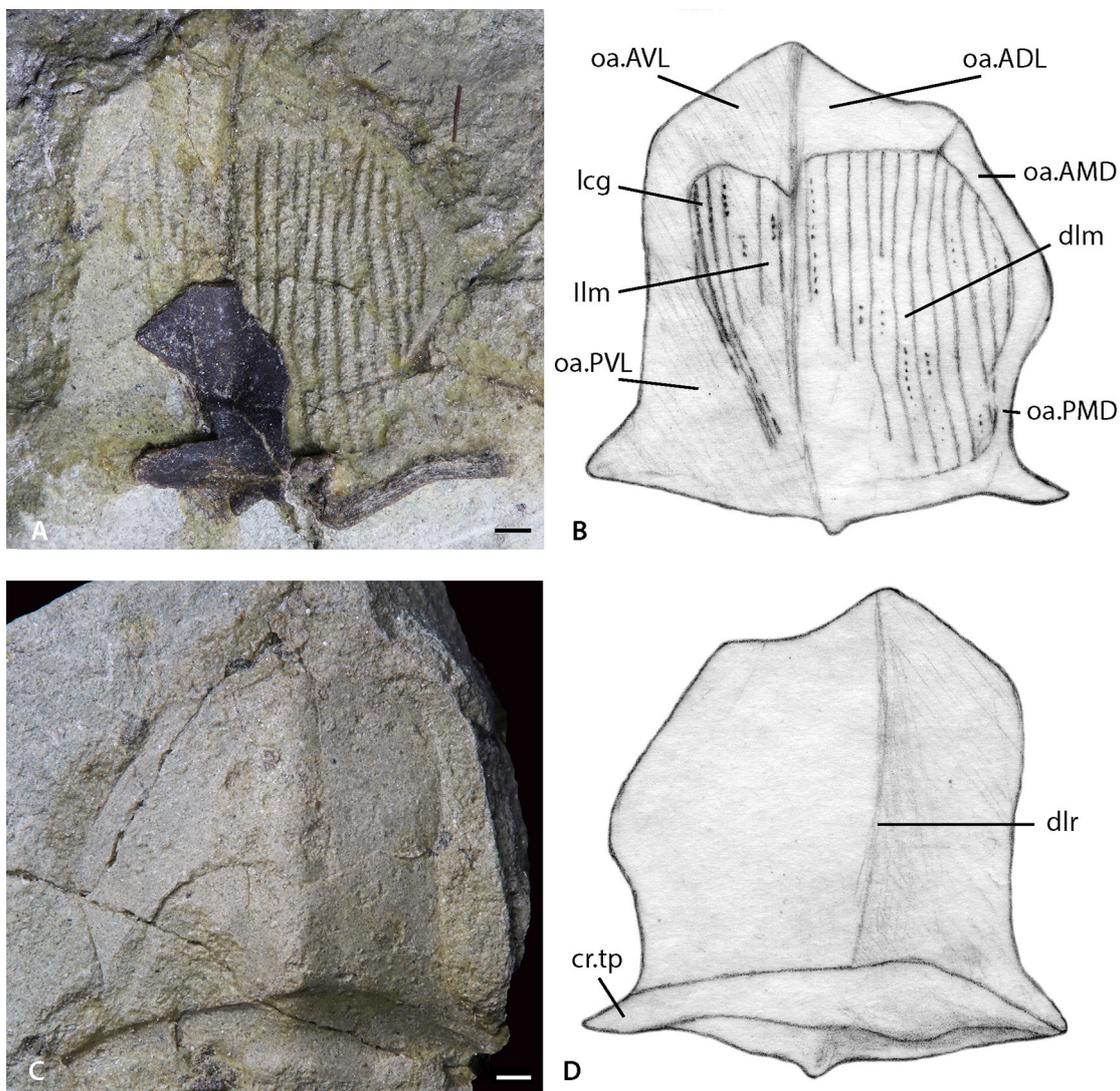


Fig. 7. *Microbrachius kedoae* from the Gavrilchitsy 45 borehole. Mixilateral plates. **A, B**, GIT 767-9 in visceral view with bone removed to show dorsal surface. **C, D**, GIT 767-10 in dorsal view with bone removed to show visceral surface. Scales bars = 1 mm. Abbreviations: ADL, anterior dorso-lateral plate; AMD, anterior median dorsal plate; AVL, anterior ventro-lateral plate; PMD, posterior median dorsal plate; PVL, posterior ventro-lateral plate; cr.tp, crista transversalis interna posterior; dlm, dorsal lamina; dlr, dorso-lateral ridge; lcg, main lateral line groove; llm, lateral lamina; oa.ADL, area overlapped by ADL; oa.AVL, area overlapped by AVL; oa.AMD, area overlapped by AMD; oa.PMD, area overlapped by PMD; oa.PVL, area overlapped by PVL.

it is an impression of the dorsal armour that is visible. GIT 767-10 (Fig. 7C, D) is preserved dorsally, but as all the bone is gone, an impression of the visceral surface is visible. The anterior border of the plate at its intersection with the dorso-lateral ridge produces a pronounced anterior corner. It passes dorsally and ventrally by rounded corners into the dorsal and lateral margins. The dorsal lamina is larger than the lateral lamina, with the mesial border being convex and the lateral border being somewhat straighter. The posterior border is slightly convex, with the dorso-lateral ridge producing a pronounced corner where it meets the border. The mesial dorsal border of GIT 767-9 has narrow overlap areas for the anterior median dorsal and posterior median dorsal plates. There are larger overlap areas for the right anterior dorso-lateral and right anterior ventro-lateral plates on the anterior border of the plate. There is a very large overlap area on the lateral border for the right posterior ventro-lateral. This results in the mixilateral plate having quite a small area exposed on the dorsal surface of the fish. The main lateral line groove is seen as a groove running posterior to anterior on the lateral lamina of the plate. The ornamentation consists of long rows of anterior–posterior running tubercles. GIT 767-10 bears a well-developed, quite thick, crista transversalis interna posterior near the posterior border.

Only right anterior ventro-lateral plates in visceral aspect are known, with GIT 767-12 (Fig. 8A, B) being the best preserved. However, it is missing most of the posterior lateral edges and the antero-lateral corner. From what can be seen, the posterior margin of the plate is concave and extended to the ventro-lateral corner. Parallel to the antero-dorsal margin and in front of the crista transversalis interna anterior, a crista postbranchialis is developed. The foramen axillare is round and quite large, although it may be somewhat eroded. The plate overlaps the right posterior ventro-lateral plate at the posterior margin, but only a small part of this area is preserved. The plate also overlaps the right anterior dorso-lateral plate on the dorsal margin, but once again only a small part of this area is preserved.

Only right posterior ventro-lateral plates in ventral and visceral aspect are known. GIT 767-1 (Fig. 9A, B) is preserved in ventral view, but most of the bone is now missing, and so mostly a cast of the visceral surface is visible. This makes specific features difficult to discern. GIT 767-18 (Fig. 9C) is preserved in visceral view, but as all the bone is missing, a cast of the ventral surface is preserved. Also, the lateral part of the plate is mostly missing. However, between GIT 767-1 and GIT 767-18 a fairly complete restoration of the morphology of the dorsal surface of the plate is possible (Fig. 9D). The

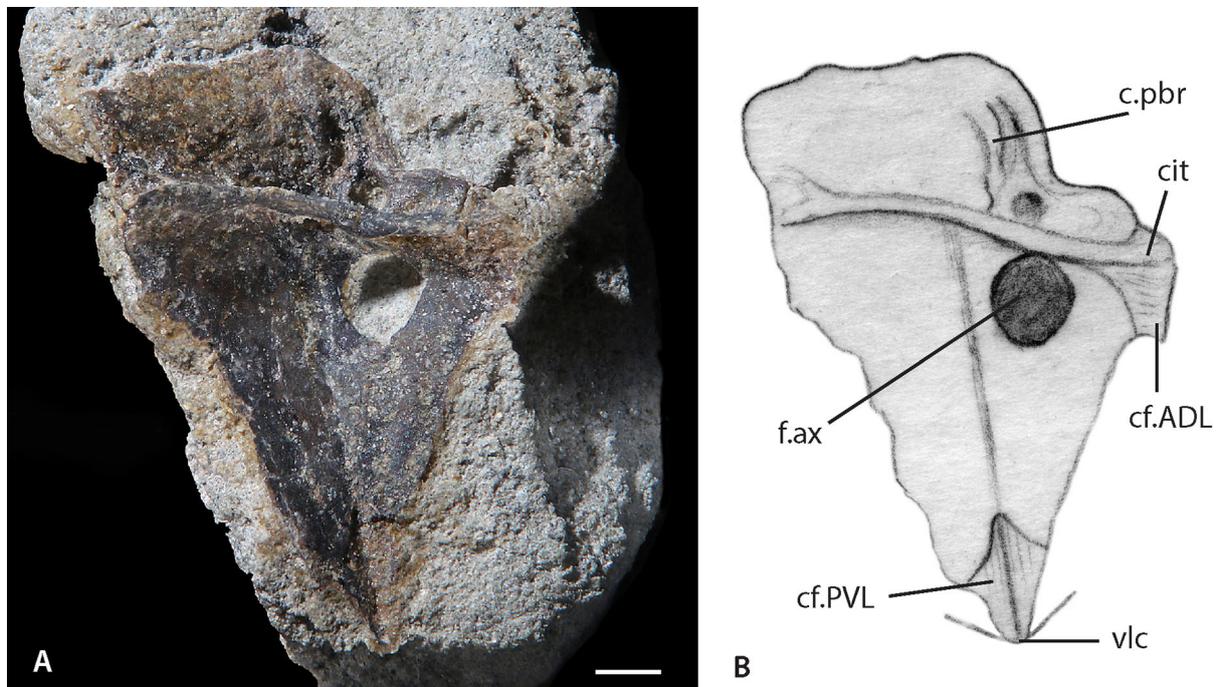


Fig. 8. *Microbrachius kedoae* from the Gavrilchitsy 45 borehole. GIT 767-12, an anterior ventro-lateral plate in visceral view. Scale bar = 1 mm. Abbreviations: ADL, anterior dorso-lateral plate; PVL, posterior ventro-lateral plate; cf.ADL, area overlapping ADL, cf.PVL, area overlapping PVL; cit, crista transversalis interna anterior; c.pbr, crista postbranchialis; f.ax, axillary foramen of anterior ventro-lateral plate; vlc, ventro-lateral corner.

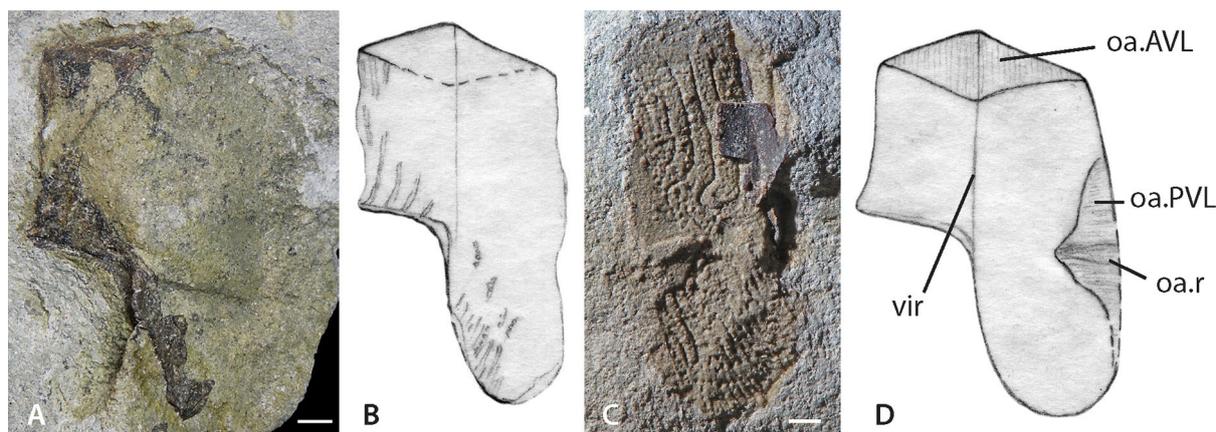


Fig. 9. *Microbrachius kedoae* from the Gavrilchitsy 45 borehole. Posterior ventro-lateral plates. **A, B**, GIT 767-1 in ventral view. **C**, GIT 767-18, in visceral view. **D**, restoration in ventral view based on A–C. Scale bars = 1 mm. Abbreviations: AVL, anterior ventro-lateral plate; PVL, posterior ventro-lateral plate; oa.AVL, area overlapped by AVL; oa.PVL, area overlapped by PVL; oa.r, overlap ridge; vir, ventro-lateral ridge of trunk armour.

anterior and posterior portions are about the same length, with the posterior portion being about half as broad as the anterior portion. The lateral margin of the posterior portion continues anteriorly as the ventro-lateral ridge. This ridge continues to the area where the plate is overlapped by the right anterior ventro-lateral plate. This area stretches the entire breadth of the anterior border and is broadest where it meets the ventro-lateral ridge. The ornament consists of prominent tubercles arranged in ridges. Towards the anterior end they are fairly evenly spaced in an anterior–posterior direction.

They become more convoluted where the left posterior ventro-lateral plate overlaps the plate before straightening up again. The left posterior ventro-lateral plate overlaps the plate midway along the length being longer than broad. At its broadest point a ridge runs laterally, similar to that seen in *Pterichthyodes* (Hemmings 1978, fig. 13A).

Two main components of the pectoral appendages are preserved, being the proximal and distal segments. The proximal segments are box-like and fairly long and slender. GIT 767-19 (Fig. 10A, B) has the socket exposed but it is badly eroded and so its original shape is hard

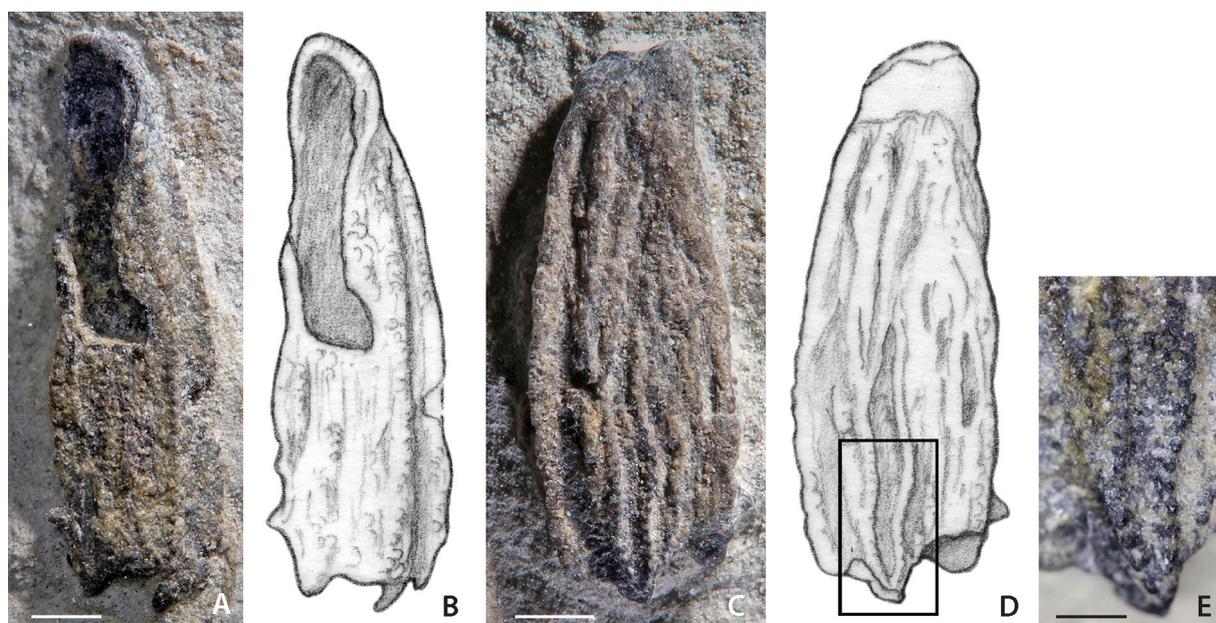


Fig. 10. *Microbrachius kedoae* from the Gavrilchitsy 45 borehole. Proximal part of the pectoral arm. **A, B**, GIT 767-19. **C–E**, GIT 767-20. A–D, scale bars = 1 mm, E, scale bar = 0.5 mm.



Fig. 11. *Microbrachius kedoae* from the Gavrilchitsy 45 borehole. Distal segment of the pectoral appendage. GIT 767-24. Scale bar = 1 mm.

to discern. The ornamentation consists of long rows of tubercles forming ridges. GIT 767-20 (Fig. 10C, E) shows this ornamentation quite well along with elongated pits. GIT 767-24 (Fig. 11) is the only distal segment known. The segment is very small and it is difficult to determine the ornamentation except at the edges. The lateral edge has fairly blunt, small tubercles. The mesial edge has large, fairly blunt, conical denticles.

DISCUSSION

Microbrachius kedoae compares well with the type species *Microbrachius dicki* which was described in detail by Hemmings (1978). Many of the dermal plates of *M. dicki* are quite variable and the dermal plates of *M. kedoae* fall into this variability for the most part. However, there are some striking morphological differences between the two species. The most obvious difference is that the mixilateral plate is overlapped by the anterior median dorsal plate in *M. kedoae* rather than the mixilateral plate overlapping the anterior median dorsal plate in *M. dicki* (see Hemmings 1978, fig. 30B, F). Also, the anterior ventro-lateral plate in *M. kedoae* has a crista postbranchialis developed unlike *M. dicki*. Another difference is the narrowness of the lateral plates in *M. kedoae* which are quite broad in *M. dicki*. Finally, another difference is that *M. kedoae* has denticles on the mesial edge of the distal segment of the pectoral appendage which are fairly blunt of the bothriolepid norm, whereas in *M. dicki* there are large, strongly recurved spines (Hemmings 1978). Long et al. (2015) speculated that these large spines allowed greater purchase in the internal fertilization process. How this relates to *M. kedoae* is uncertain.

Two Chinese *Microbrachius* species are also known. *Microbrachius sinensis* was erected on a limited number of isolated dermal plates. This species is found in the upper part of the Qujing Formation, near Qujing, Yunnan Province in southern China and is dated Late Eifelian

(Pan 1984). It is therefore earlier than *M. dicki* and *M. kedoae*. *Microbrachius kedoae* differs from *M. sinensis* in that *M. sinensis* does not have well-developed lateral corners on the anterior median dorsal plate. Another difference is that the ornamentation of *M. sinensis* consists of tubercles fused into distinct lines without the isolated tubercles seen in *M. kedoae*. Also, a number of anterior median dorsal plates are known in *M. sinensis*, which show a fairly consistent breadth/length ratio of 100 which is considerably lower than in *M. kedoae*. Further detailed comparison of the diagnostic characters of *M. kedoae* with *M. sinensis* is hampered by the lack of material in *M. sinensis*. Unfortunately the anterior ventro-lateral plates in *M. sinensis* are not well enough preserved to show if a crista postbranchialis is developed or not. Also, there are no mixilateral plates, lateral plates or distal segments of the pectoral appendage known of *M. sinensis*.

The other Chinese species, *Microbrachius chuandongensis* was erected on articulated specimens that are not particularly well preserved. *Microbrachius chuandongensis* is found in the Chuandong Formation, near Qujing and is dated as Late Emsian, thus making it the oldest known *Microbrachius* species. It differs from *M. kedoae* in a number of important characters, including the mixilateral plate overlapping the anterior median dorsal plate rather than the other way round. Also, the anterior median dorsal plate does not have an anterior ventral pit as is the case in *M. kedoae* and the breadth/length ratio of this plate is around 100, so considerably less than in *M. kedoae*. The lateral plates are also much wider in *M. chuandongensis* than in *M. kedoae*. Other *M. kedoae* diagnostic characters we cannot compare with *M. chuandongensis* as viscerally preserved anterior ventro-lateral plates or distal segments of the pectoral appendages are unknown in the Chinese species. However, the most conspicuous character of *M. chuandongensis* is the very short posterior median dorsal plate which is much shorter and smaller than the anterior median dorsal plate. This also distinguished it from *M. dicki* and we have our doubts the species actually belongs in *Microbrachius*.

The Gavrilchitsy 45 core was taken by A. Fursenko in 1954 near the village of Gavrilchitsy southwest of the town of Soligorsk in southern Belarus. The *M. kedoae* remains were recovered from a single siltstone sample from a depth of 225.25 to 228.95 m along with unidentifiable osteolepid remains (D. Plax pers. comm. 2017). The siltstone is part of the Moroch Beds of the Polotsk Regional Stage (Plax 2008a, 2008b) which has recently been dated to the Givetian (Kruczek et al. 2010). This is significant as originally this part of the core was thought to be in the higher Lan Regional Stage. Mark-

Kurik (2000, fig. 2) correlated the Moroch Beds with the Abava Member of the Burtneki Formation in Estonia, which also contains remains of *Microbrachius* sp. (Long et al. 2015). The Abava Member has been correlated with the Eday Flagstone Formation of Scotland (Mark-Kurik & Põldvere 2012, fig. 3) where *Microbrachius dicki* is found. This means that *Microbrachius* could act as a zone fossil between Scotland, Estonia and Belarus.

CONCLUSIONS

Microbrachius kedoae is closely related to *M. dicki* with only a number of minor differences. The two Chinese species are morphologically quite different. The fact that *Microbrachius* is found at the same horizon in Scotland, Estonia and Belarus is highly significant for biostratigraphy. Also of note were Burrow et al. (2016) reporting the Orcadian Basin acanthodian, *Diplacanthus crassissimus* Duff 1842 in the Moroch Beds. However, by the Eday Flagstone Formation, acanthodians have become extinct in the Orcadian Basin. It is hoped that continued investigation of the Belarusian, Estonian and Scottish fauna will further refine the biostratigraphy between these areas.

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Antiarhi *Microbrachius*'e uus liik Valgevene Kesk-Devonist (Givet' lade)

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Antiarhi uus liik *Microbrachius kedoae* n. sp. on kirjeldatud Valgevene Kesk-Devonist (Givet' lade). Liik põhineb üksikutel nahaplaatidel, mis on leitud Gavriltsitsõ puursüdamikust 25 km Soligorski linnast edelas. *M. kedoae* on hästi võrreldav selle perekonna tüüpliigiga *Microbrachius dicki* Šotimaalt, kuid erineb nii sellest kui ka teistest perekonna *Microbrachius*'e liikidest erineva mixilateraalplaadi poolest. Viimane on kaetud anteriormediaan-dorsaalplaadiga, mille külgedel on nurgad. *Microbrachius*'e samaaegne esinemine Šotimaal ja Valgevenes tugevdab arusaama, et nende piirkondade fauna oli Kesk-Devonis seotud.