
***Ventichthys biospeedoi* n. gen. et sp. (Teleostei, Ophidiidae) from a hydrothermal vent in the South East Pacific**

Jørgen G. Nielsen (1), Peter Rask Møller (1) & Michel Segonzac (2)

(1) Zoological Museum, University of Copenhagen, Universitetsparken 15, 2100 Copenhagen Ø, Denmark

(2) Ifremer, Centre de Brest, DEEP/Laboratoire Environnement profond-Centob, BP 70, 29280 Plouzané, France

Abstract: A new genus and species of ophidiid fishes, *Ventichthys biospeedoi*, is described based on two male specimens caught by the French BIOSPEEDO expedition to the South East Pacific Rise. They were caught by a baited trap at the hydrothermal vent site Oasis (17°25.38'S, 113°12.29'W) at 2586 m. The new genus differs from all of the 48 known ophidiid genera by the thick skin, the posteriorly placed and enlarged kidneys, the broad head, and 4 lateral lines. The most similar genera are *Benthocometes* and *Petrotyx* having a blunt snout, one basibranchial tooth patch, granular teeth, and no free pectoral fin rays. Remarks on the ecology of the new species are based on analysis of video documents taken in situ by a submarine *Nautilie*.

Key words: Ophidiidae, *Ventichthys biospeedoi* n. gen. et sp. – South East Pacific Rise - hydrothermal vent.

Introduction

Since the first hydrothermal vents were discovered about 30 years ago they have been intensively studied. From the East Pacific hydrothermal vents ten species of fish have been recorded (Biscoito et al. 2002). Of these five have been described, including *Thermichthys hollisi* (Cohen et al. 1990) belonging to the order Ophidiiformes.

During the French BIOSPEEDO cruise to the South East Pacific Rise in 2004 two 25-30 cm specimens of an unknown fish were caught at a hydrothermal vent at a depth of 2586 m. They belong to the order Ophidiiformes judging from the joined vertical fins, two rays in each pelvic fin, the number of rays in dorsal and anal fins exceeds the number of adjacent vertebrae and all fins with soft rays (Nielsen et al. 1999). The presence of a supramaxilla and the equal length of the rays in the dorsal and anal fins exclude the Carapidae and the presence of scales and a swimbladder exclude the Aphyonidae. This leaves the Ophidiidae and the Bythitidae. The most similar looking genera from these families are the pelagic *Thalassobathia* Cohen, 1963 and the hydrothermal vent fish *Thermichthys* Nielsen and Cohen, in press. Both genera belong to the viviparous family Bythitidae in which males are provided with an intromittant organ. However, of the present two specimens one is eviscerated and the other is a male and the fact that the latter lacks an intromittant organ shows, that they should be referred to the oviparous family Ophidiidae. Of the four ophidiid subfamilies the Brotulinae have barbels on the snout and chin, the pelvic fins in adult Brotulotaeniinae are absent (Fahay & Nielsen 2003), and in Ophidiinae the pelvic fins are placed below the eye on a slender bony filament extending forwards from the cleithrum. As none of these diagnostic characters occur in the present two specimens they will be referred to the subfamily Neobythitinae.

Table 1 compares important characters of the families Ophidiidae and Bythitidae to the present new genus showing that it is a typical ophidiid genus.

Table 1. Family characters of Bythitidae and Ophidiidae compared to *Ventichthys*.

	Bythitidae	Ophidiidae	<i>Ventichthys</i>
Basibranchial tooth patches	Never present	Almost always present	Present
No. of long gill rakers	Rarely more than 5	Rarely less than 5	10-11
Position of anterior nostril	Immediately above upper lip in ca. 90% of the spp.	Midway between lip and post. nostril	Midway between lip and post. nostril
Copulatory organ	Present	Absent	Absent
No. of pelvic fin rays	0-1 (except for 2 in 1 genus)	0-2	2

Comparative material and methods

Ophidiidae

Benthocometes robustus (Goode and Bean, 1886): Instituto Investigaciones Pesqueras, Barcelona 348-350/1987 (SL 118-122 mm), ISH 1921/68 (SL 100 and 107 mm), ZMUC P77683 (95 mm). - *Petrotyx hopkinsi* Heller and Snodgrass, 1903: LACM 32271-24 (SL 147 mm), LACM 45581-6 (SL 208 mm), ZMUC P77545 (SL 160+ mm).

Bythitidae

Thermichthys hollisi (Cohen, Rosenblatt & Moser, 1990): SIO 88-97 (SL 304 mm), MNHN 2004-2039 (SL 218 mm). – *Thalassobathia nelsoni* Lee, 1974: SIO 72-164 (SL 155 mm). – *Thalassobathia pelagica* Cohen, 1963: ZMUC P77442, P77731, P77853 (SL 255-265 mm).

Ventichthys gen. nov.

Type species: *Ventichthys biospeedoi* n. sp. (type locality: South East Pacific Rise, 17°25.38'S, 113°12.29'W, 2586 m).

Diagnosis. An ophidiid genus with robust body, very small, overlapping scales on head and body, thick skin, posteriorly placed enlarged kidneys and four lateral lines; dorsal fin origin above tip of pectorals, basis of pelvic fins below hind margin of opercle; head broad with blunt snout; strong opercular spine covered by thick skin; upper jaw ends just behind eye; teeth granular, one median basibranchial tooth patch; anterior gill arch with 10-11 long rakers; number of rays in dorsal fin 80-89, caudal fin 8, anal fin 64-72, pelvic fin 2, pectoral fin 24-25; number of vertebrae 16-17 + 36 (in total 52-53).

Similarity. A phylogenetic analysis of the Ophidiidae needs to be made, but there are two genera, *Benthocometes* (Goode and Bean, 1886) and *Petrotyx* Heller and Snodgrass, 1903 which are similar to *Ventichthys* by having a blunt snout, no free pectoral fin rays, granular teeth, and one basibranchial tooth patch. The differences between the three genera are shown in Table 2.

Etymology. *Vent* refers to the hydrothermal vent and *ichthys* to fish.

Table 2: *Ventichthys* compared to similar genera.

	<i>Ventichthys</i>	<i>Benthocometes</i>	<i>Petrotyx</i>
Lateral lines	4	1	1
Opercular spine	1	2	0
Long gill rakers	10-11	7-10	3
Caudal fin rays	8	10	10
Pectoral fin rays	24-25	27-33	24
Kidneys	Posteriorly placed and enlarged	Dorsally placed, not enlarged	Dorsally placed, not enlarged

Ventichthys biospeedoi, new species
(Figs 1-8)
Ophidiidae: Geistdoerfer 1996, fig. 6.

Holotype: MNHN 2004-2037, 266 mm SL, male, South East Pacific Rise, hydrothermal vent site Oasis, 17°25.38'S, 113°12.29'W; BIOSPEEDO cruise, submersible Nautille, R/V Atlantis, dive PL 1582, baited trap B2, depth 2586 m, 29 April 2004, collected by D. Jollivet (Roscoff, France).

Paratype: MNHN 2004-2038, 282 mm SL, sex unknown, same data as for holotype. Prior to the taxonomic examination the paratype had been eviscerated so that only the kidneys remain.

Diagnosis. See generic diagnosis.

Description. The principal meristic and morphometric characters are shown in Table 3. Where there are differences between the holo- and the paratype those of the paratype are given in brackets.

Body short and compressed and snout blunt; small, oval, imbricate scales covering body, head and proximal part of dorsal, caudal, anal and pectoral fins; ca. 250 scales in a line from upper part of gill slit to base of caudal fin; dorsal fin origin above hind margin of pectoral fin, anal fin origin slightly behind midpoint of fish, pectoral fin short and rounded, and longest pelvic fin ray reaching one fourth the distance from its base to anal fin; length of head about twice in preanal length; horizontal diameter of eye 1.5 times in length of snout; anterior nostril placed midway between upper lip and posterior nostril, both nostrils with a low rim; upper jaw ending just behind eye, maxillaries partly sheathed postero-dorsally; a strong opercular spine well hidden by skin; anterior gill arch (Fig. 2) with 5(3) knobs on upper branch, 1 long raker in the angle and lower branch with 10(9) long and 6 knobs; 65 gill filaments, longer than the long gill rakers; length of the 2 pseudobranchial filaments about half eye diameter.

Dentition (Fig. 3). All teeth small and conical; premaxilla with 5 rows anteriorly at symphysis, merging into 3 rows posteriorad; vomer horseshoe-shaped, with 13(25) teeth in 2-3 rows; palatines with 6(5) rows of up to 15(19) teeth; dentary with 4 rows anteriorly at symphysis, merging into 2 rows posteriorad. One median basibranchial tooth patch with rather weak teeth.

Head pores (Fig. 4). Supraorbital pores 1 placed above opercular flap (often termed "first lateral line pore"); infraorbital pores 5(3 anterior and 2 posterior), the posterior one the largest; mandibular pores 5(2 anterior and 3 posterior), the second anterior pore from both sides with joint opening, the posterior pore large with low rim; preopercular pore 1.

Lateral line (Fig. 4). Four rows of small, tube-shaped, widely separated neuromasts. A short row in front of the dorsal fin with 12(10) neuromasts, a row below the entire dorsal fin with 45(44) neuromasts, a median row from a vertical through the anal fin origin to the origin of the caudal fin with 15(14) neuromasts, and a ventral row from a vertical through origin of the anal fin to origin of the caudal fin with 15(12) neuromasts. The small neuromasts are very difficult to observe having a colour similar to the body.

Sagittal otolith (Fig. 5). Sagitta oval and thick, 1.5 times as long as high and 3 times as long as thick. The large sulcus is undivided and much wider anteriorly than posteriorly. The dorsal rim is flat with a pronounced postdorsal angle.

Axial skeleton (Fig. 6). Tips of neural and haemal spines pointed; first neural spine half the length of second spine; vertebrae 4-9 with somewhat depressed neural spines; bases of vertebrae 5-12 enlarged; parapophyses on posterior 9 precaudal vertebrae; pleural ribs on vertebrae 3-17(3-16); epipleural ribs on vertebrae 5-16(4-15).

Internal organs. The 15 mm long and 5 mm broad testes are joined in a spindle-like shape similar to the ovaries in many other ophidiiform species. Histological sections showed, however, typical unripe testicular tissue. The kidneys are unusual by being located posterior to the thick-skinned swimbladder and by forming a large, compact, dark-blue body posterior-most in the abdominal cavity (Fig. 7); histological sections of the "body" from the paratype proved kidney tissue. The large stomach almost reaches the anal opening and the short intestine forms four coils. One thick pyloric coeca.

Coloration. After one year of preservation the specimens are light brown to whitish with bluish eyes. Photos of *Ventichthys biospeedoi* specimens taken *in situ* show a greyish coloration.

Table 3. Meristic and morphometric characters of *Ventichthys biospeedoi*.

	HT MNHN 2004-037	PT MNHN 2004-2038
Total length	285	300
Standard length	266	282
Meristic characters		
Dorsal fin rays	80	89
Caudal fin rays	8	8
Anal fin rays	64	72
Pectoral fin rays	24/25	25/25
Pelvic fin rays	2	2
Vertebrae	17+36	16+36
Pseudobranchial filament	2	2
Ant. dorsal ray above vertebra no	10	10
Ant. anal ray below dorsal ray no.	23	21
Ant. anal ray below vertebra no.	21	19
Total gill rakers	22	19
Long gill rakers	11	10
Morphometric characters		
Head length	25.5	23.5
Width of head	16.5	13.5
Upper jaw length	11.5	11.0
Maxillary height	3.4	2.7
Diameter eye window	3.5	3.3
Interorbital width	7.3	6.4
Postorbital length	18.0	15.5
Prepelvic length	21.5	21.5
Preanal length	55	53
Predorsal length	37.5	35.0
Depth at anus	21.5	18.5
Base of pelvic to orig. of anal fin	34.5	33.5
Pectoral fin length	12.0	10.5
Pelvic fin length	10.0	8.6

Biology. The holotype, a male with spindle-formed, unripe testes, does not contain any identifiable stomach contents. The paratype was eviscerated only leaving the strangely formed kidneys which may be an adaptation to the special conditions near the vents. The capture of the two specimens in a baited trap indicates a necrophagous diet. Fig. 8A shows specimens grazing on the bottom. The poorly developed teeth and the presence of 10-11 long gill rakers on the anterior arch indicate that it preys upon rather small food-items. The thick skin could be an adaptation to endure the high temperatures in the hydrothermal vent area. The same condition is found in another vent-fish, *Thermichthys hollisi*. The presence of a male without an intromittant organ shows that it is oviparous.

Habitat. The vent site Oasis is composed of active black smokers covered with *Alvinella* spp., large patches of mussels, clams and stalked cirripeds. A milky fluid diffuses from crevices and collapsed lava lakes, with clouds of swimming amphipods. The two specimens here studied were collected next to such a hole (Jollivet et al., 2004, fig. 3), surrounded by the mytilid mussel *Bathymodiolus thermophilus* Kenk & Wilson, 1985, the clam *Calyptogena magnifica* Boss & Turner, 1980, the stalked barnacle *Neolepas* cf. *zevinae* Newman, 1979, actinostolid sea-anemonies (*Chondrophellia*-like), the bythograeid crab *Bythograea thermydron* Williams, 1980, the galatheid crab *Munidopsis subsquamosa* Henderson, 1885 and a recently described nematocarcinid shrimp, *Nematocarcinus burukowskyi* Komai & Segonzac, 2005. Other fish occur in this environment such as the synphobranchid *Ilyophis saldanhai* Karmovskaya & Parin, 1999, the bythitid *Thermichthys hollisi* (Cohen et al., 1990) and an unidentified hagfish. Additional *V. biospeedoi* specimens were observed at other sites (see "Distribution") visited during the BIOSPEEDO cruise, between 2585 and 2840 m (Jollivet et al., 2004), at places sometimes ten or more individuals swimming in the shimmering vent fluids with temperatures between 2 and 7°C (Fig. 8B).

Distribution. Known only from the South East Pacific Rise, where it was caught on hydrothermal vent site Oasis (17°25.38'S, 113°12.29'W, 2586 m) and observed on three additional sites: Yaquina (7°25'S, 107°48'W, 2750 m), Hobbs (17°35'S, 113°15'W, 2595 m) and Grommit (21°34'S, 114°18'W, 2840 m).

Acknowledgments

We thank Didier Jollivet (chief scientist of the BIOSPEEDO cruise, Roscoff, France) for collecting the specimens here studied. The cruise was supported by the French programme 'DORSALES' and the Ecchis GDR (CNRS and IFREMER). We are thankful to Patrice Pruvost, MNHN, for sending us the material here studied and to Jeff Seigal, LACM and H. J. Walker, SIO for sending comparative material. Also thanks to Åse Jespersen, Biological Institute, University of Copenhagen, for making the histological sections, to Werner Schwarzhans, Hamburg, for illustrating the otolith and to Patrick Briand (Ifremer) for in situ photos (Fig. 8).

References

- Biscoito, M., Segonzac, M., Almeida, A.J., Desbruyères, D., Geistdoerfer, P., Turnipseed, M. & Van Dover, C. 2002 Fishes from the hydrothermal vents and cold seeps – An update. *Cah. Biol. Mar.*, 43, 359-362.
- Cohen, D.M. (1963) A new genus and species of bathypelagic ophidioid fish from the western North Atlantic. *Breviora*, 196, 1-8.

- Cohen, D.M., Rosenblatt, R.H. & Moser, H.G. (1990) Biology and description of a bythitid fish from deep-sea thermal vents in the tropical eastern Pacific. *Deep-Sea Research*, 37, 267-283.
- Fahay, P.H. & Nielsen, J.G. (2003) Ontogenetic evidence supporting a relationship between *Brotulotaenia* and *Lamprogrammus* (Ophidiiformes: Ophidiidae) based on the morphology of exterilium and rubaniform larvae. *Ichthyological Research*, 50, 209-220.
- Geistdoerfer, P. (1996) L'ichthyofaune des écosystèmes associés à l'hydrothermalisme océanique: état des connaissances et résultats nouveaux. *Oceanologica Acta*, 19(5), 539-548.
- Goode, G.B. & Bean, T.H. (1886) Description of thirteen species and two genera of fishes from the "Blake" collection. *Bulletin of the Museum of Comparative Zoology Harvard Collection*, 12, 153-170.
- Heller, E. & Snodgrass, R.E. (1903) Papers from the Hopkins Stanford Galapagos Expedition, 1898-1899. XV. New fishes. *Proceedings of the Academy of Sciences Washington*, 5, 189-229.
- Jollivet D., Lallier, F. H., Barnay, A.-S., Bienvenu N., Bonnivard E., Briand P., Cambon-Bonavita M.-A., Comtet T., Cosson R., Daguin C., Donval J.-P., Fauré, B., Gaillard, M., Glippa, V., Guillou L., Hourdez S., Le Bris N., Morand S., Pradillon F., Rees J.-F., Segonzac M., Shillito B., Thiebaut E. & Viard F. (2004) The BIOSPEEDO Cruise: a new survey of hydrothermal vents along the South East Pacific Rise from 7°24'S to 21°33'S. *InterRidge*, 13, 20-26.
- Lee, R.S. (1974) *Thalassobathia nelsoni*, a new species of bathypelagic ophidioid fish from Chilean waters. *Copeia*, 1974(3), 629-632.
- Nielsen, J.G., Cohen, D.M., Markle, D.F. & Robins, C.R. (1999) FAO species catalogue. Volume 18. Ophidiiform fishes of the world (order Ophidiiformes). *FAO Fisheries Synopsis*. No. 125, Vol. 18. Rome, FAO.1999. 178 pp.
- Nielsen, J.G. & Cohen, D.M. (2005) *Thermichthys* (Bythitidae), replacement name for preoccupied *Gerhardia* Nielsen & Cohen, 2002 and a second specimen of *Thermichthys hollisi* from the Southeast Pacific. *Cybium*, 29(4), 395-398.

Figure legends

Fig. 1 *Ventichthys biospeedoi*, holotype, MNHN 2004-2037, SL 266 mm (Geert Brovad photo).



Fig. 2 *Ventichthys biospeedoi*, holotype, anterior right gill arch (Birgitte Rubæk ill.).

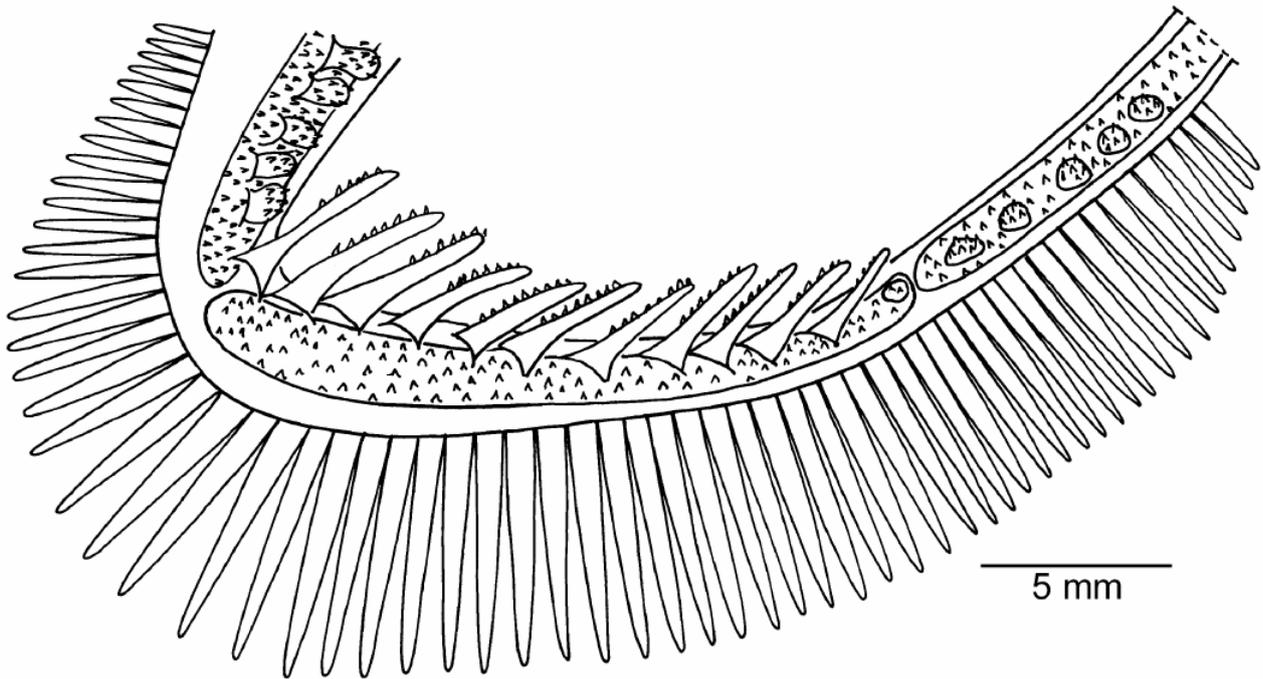


Fig. 3 *Ventichthys biospeedoi*, holotype, dentition: A-basibranchial tooth patch, B-vomer, C-palatines.

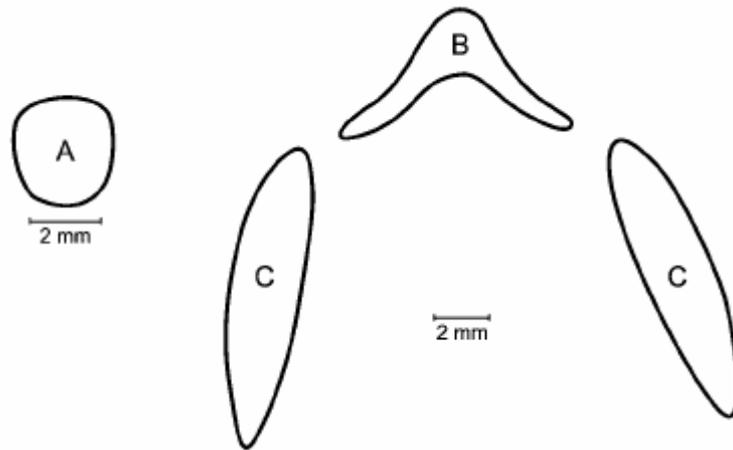


Fig. 4 *Ventichthys biospeedoi*, holotype, head pores and lateral lines (Birgitte Rubæk ill.).

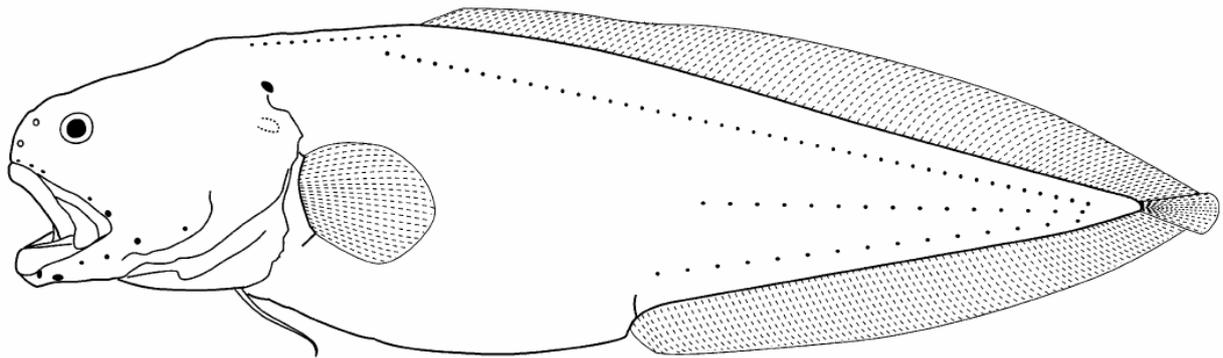


Fig. 5 *Ventichthys biospeedoi*, holotype, right sagittal otolith: A-median view, B-frontal view, C-ventral view.

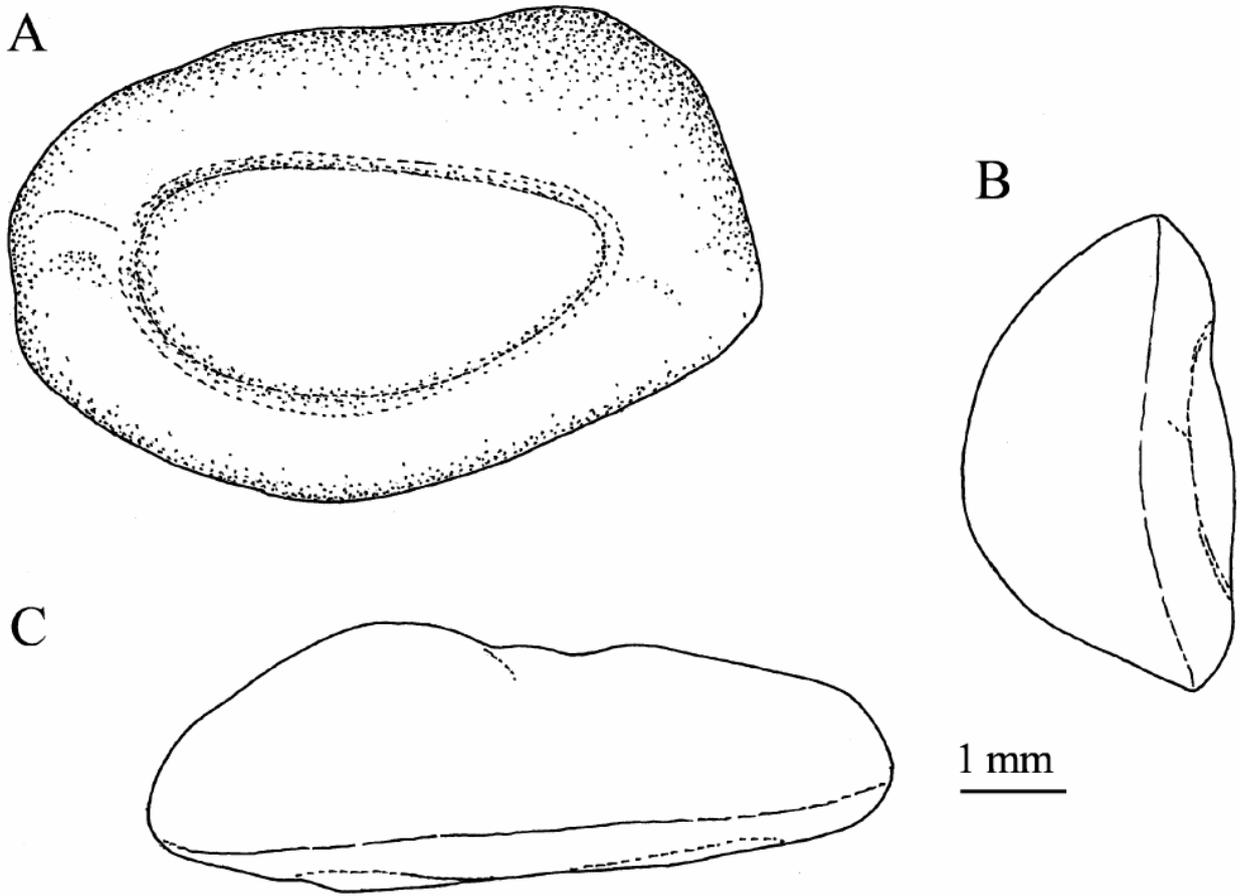


Fig. 6 *Ventichthys biospeedoi*, holotype, radiograph.

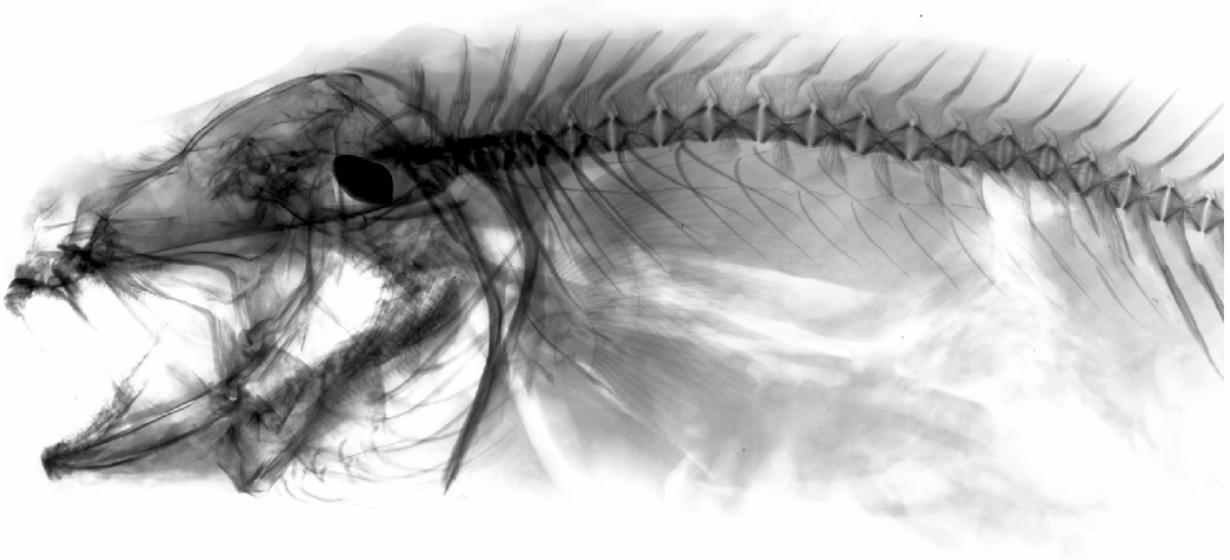


Fig. 7 *Ventichthys biospeedoi*, paratype, kidneys.



Fig. 8 *Ventichthys biospeedoi* from site Oasis (copyright fremer/BIOSPEEDOI/D. Jollivet: A – over bottom with galatheid crab *Munidopsis subsquamosa*, stalked barnacle *Neolepas cf. rapanui* and actinostolid sea-anemone *Chondrophellia* sp., B – swimming over mussel bed in shimmering, milky fluids emanating from cracks in the basalt.

