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Fish otoliths from the upper part of mid-Oligocene freshwater molasse, Eastern Switzerland

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ABSTRACT

Some fish otoliths from the "Ebnater Schichten" in the lower freshwater molasse (USM) in the eastern part of Switzerland are described.

They originate from the families Chandidae and Gobiidae, and include two new species *(Gobius irregularis, Dapalis rectangularis)*. The age of these otoliths is based on the evidence of small mammalian teeth and pollen which accompany the otoliths.

ZUSAMMENFASSUNG

Aus der Unteren Süsswassermolasse der Ostschweiz (Ebnater Schichten, Speer-Schüttung s.str.) werden drei Otolithen-Arten aus der Familie der Chandidae und der Gobiidae beschrieben, wovon je eine neue Species: *Gobius irregularis* und *Dapalis rectangularis*.

Das Alter dieser Otolithen kann anhand von Kleinsäuger-Zähnen und einer Pollen-Assoziation exakt ermittelt werden.

Introduction

The lithostratigraphy and biostratigraphy of sediments from the lower marine molasse and overlying fluvial sediments from the Speer Delta Complex (USM) are being studied as part of a dissertation by one of us (H.P.F.).

In the Ebnater Beds washed residues included a rich fauna of small mammalian fossils as well as Chara, ostracods, pharyngeal teeth from cyprinoid fishes and 19 fish otoliths.

U. Oberli, Zürich, discovered and sampled these fossil horizons, generously placing his material at our disposal. This, together with material from our collections, forms the basis of this work.

At present, the otoliths do not assist with problems of the stratigraphy of the Swiss Molasse. However, two new species have been identified by one of us (F.C.S.) and these will be described subsequently.

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Stratigraphy

1. Lithology

The Ebnat Beds are over 1,000 m thick and are interpreted as the distal facies of sediments deriving from the Speer Delta Complex.

In more external zones they progress into a more sandy to marly facies. A major portion of the unit comprises medium to coarse-grained calcarenite designated the Ebnat Sandstone. There are scattered pebble lenticles and fine-pebble limestone conglomerates.

Steep-angle crossbeds are common and unusual flow structure bottom marks occur. The otoliths are found in a marly intercalation within the Ebnat Sandstone. They come from the Schmitt Quarry, northeast of the community of Ebnat-Kappel, Obertoggenburg, St. Gall (sheet Nesslau, 1114, coord. 728870/236475).

2. Age

Mrs Hugueney, Lyon, determined the small mammalian teeth. The fauna, consisting of Theridomyidae, Cricetidae and Eomyidae, compared closely in dimensions and structures with similar teeth from Pech-du-Fraysse (Quercy) and Gaimersheim. These fossil locations are considered as synchronous with the reference location at Boningen. The small mammal fauna of Ebnat-Kappel must therefore correlate with the mammal subzone Boningen which, according to THALER 1965, occurs in the Biozone of Cournon.

HOCHULI (1978) used pollen evidence to place the Ebnat Beds into Floral Paleogene zone 20b. This correlates with the late Rupelien (mid-Oligocene) of the Central Paratethys. The absolute age limits lie between 28 and 30 my (after STEININGER, RÖGL & MARTINI 1976).

Otoliths

Superorder ***Acanthopterygii***

Order ***Perciformes***

Suborder ***Percoidei***

Family ***Chandidae***

Genus *Dapalis* GISTEL 1848
(Synonym: *Smerdis* AGASSIZ 1833, nom. preocc.)

Type species: Perca minuta BLAINVILLE.

Dapalis rectangularis n.sp.

Pl. 1, Fig. 1a, b, 2, 3

Name. - Latin *rectangularis* refers to the rectangular shape of the ostium.
Holotype. - Registration No. A/I 810, Pl. 1, Fig. 1a, b

Papatypes. - Registration No. A/I 811, A/I 812, Pl. 1, Fig. 2, 3

Description of holotype. - A rather rhomboidal, left sacculith. Dorsal rim short, horizontal, slightly concave; posterior rim oblique, undulant; ventral rim angularly rounded, crenulated; anterior rim oblique, markedly undulant ventrally, becoming straight. Outer face convex, with a slightly excentric central umbo and radial ribbing on the peripheries. Inner face slightly convex. Sulcus opening widely on the anterior rim and terminating near the posterior point of the otolith. Ostium wide, spatulate, rather rectangular; cauda narrow, slightly undulant, tapering terminally. Crista superior slightly undulant, accentuated by a shallow depression above it. A slight, rounded upper angle and lower right-angle present at the junction of ostium and cauda. A blunt rostrum, slight antirostrum and excisura present; no collicula. Lower area semicircular with an indistinct border of narrow, beaded ribbing; dorsal area depressed but thickened peripherally.

One of the paratypes (Pl. 1, Fig. 2) is a right sacculith from a younger fish. It is similar to the holotype but shows a marked notch on the posterior rim. The other paratype (Pl. 1, Fig. 3) is an eroded right sacculith which has lost the peripheral ornamentation.

Dimensions. - Holotype: length 1.85 mm, height 1.55 mm
Plate 1, Figure 2: length 1.52 mm, height 1.10 mm
Plate 1, Figure 3: length 3.40 mm, height 2.55 mm

Discussion. - The very wide, angular ostium in this species easily distinguishes it from other known species. In other respects its characteristics are those of the type species.

Suborder ***Gobioidei***

Family ***Gobiidae***

Genus *Gobius* LINNAEUS 1758

Type species: Gobius niger LINNAEUS

Gobius sectus STINTON & KISSLING

Pl. 1, Fig. 4a, b, 5, 6

1968 *Gobius sectus* STINTON & KISSLING, p. 149, Pl. 1, Fig. 5.

Material. - Three right sacculiths, registration No. A/I 813 (Pl. 1, Fig. 4), A/I 814 (Pl. 1, Fig. 5), A/I 815 (Pl. 1, Fig. 6).

Description. - Plate 1, Figure 4a and b, is a relatively well-preserved right sacculith showing the characteristics of the holotype. Plate 1, Figure 5, shows the same features but is from a younger fish. Plate 1, Figure 6, has suffered from erosion which has rounded the peripheral contours.

Dimensions. - Plate 1, Figure 4: length 3.1 mm, height 2.4 mm
Plate 1, Figure 5: length 2.2 mm, height 1.7 mm
Plate 1, Figure 6: length 1.0 mm, height 1.4 mm

Gobius irregularis n.sp.

Pl. 1, Fig. 7a, b

Name. - Latin *irregularis* refers to the irregular peripheral contours.
Holotype. - Registration No. A/I 816, a right sacculith.

Description. - A rather eroded, right sacculith. Dorsal rim domed, bicrenulate, short; posterior rim rather oblique, long, finely crenulated on the dorsal half and with a central point; ventral rim shallowly concave; anterior rim nearly vertical, with a very shallow, wide notch. Outer face smooth, thickened dorsally, with peripheral tubercles on the dorsal area. Inner face convex. Sulcus slightly upturned, opening on the anterior rim as a very narrow groove and terminating well short of the posterior rim. Ostium rather oval and wide; cauda short, arcuate. Crista superior thickened and accentuated by a depression above it. A rounded lower angle at the junction of ostium and cauda. Blunt rostrum, no antirostrum, excisura or collicula. Lower area thickened immediately below the crista inferior, bounded by a narrow, semicircular groove and with a thickened ventral periphery. Dorsal area compressed but thickened peripherally. Posterior area compressed.

Dimensions. - Holotype: length 1.9 mm, height 1.5 mm

Discussion. - The features of the sulcus are typically gobioid, as are the peripheral contours but the irregular posterior rim distinguishes this species from other known forms. *Gobius sectus* STINTON & KISSLING and *Lepidogobius bifidus* STINTON & KISSLING, are both rectangular in outline.

Conclusions

It is evident from the accompanying fauna that these otoliths derive from freshwater species of fish. Both the Chandidae and Gobiidae are known to inhabit marine, estuarine and purely fluviatile waters.

Dapalis is closely related to *Chanda,* if not synonymous with it. STINTON (1978) has revised its taxonomy.

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Plate 1

Fig. 1a, 1b *Dapalis rectangularis* n.sp. (holotype). A/I 810. ×25.

Fig. 2 *Dapalis rectangularis* n.sp. A/I 811. ×25.

Fig. 3 *Dapalis rectangularis* n.sp. A/I 812. ×10.

Fig. 4a, 4b *Gobius sectus* STINTON & KISSLING. A/I 813. ×14.

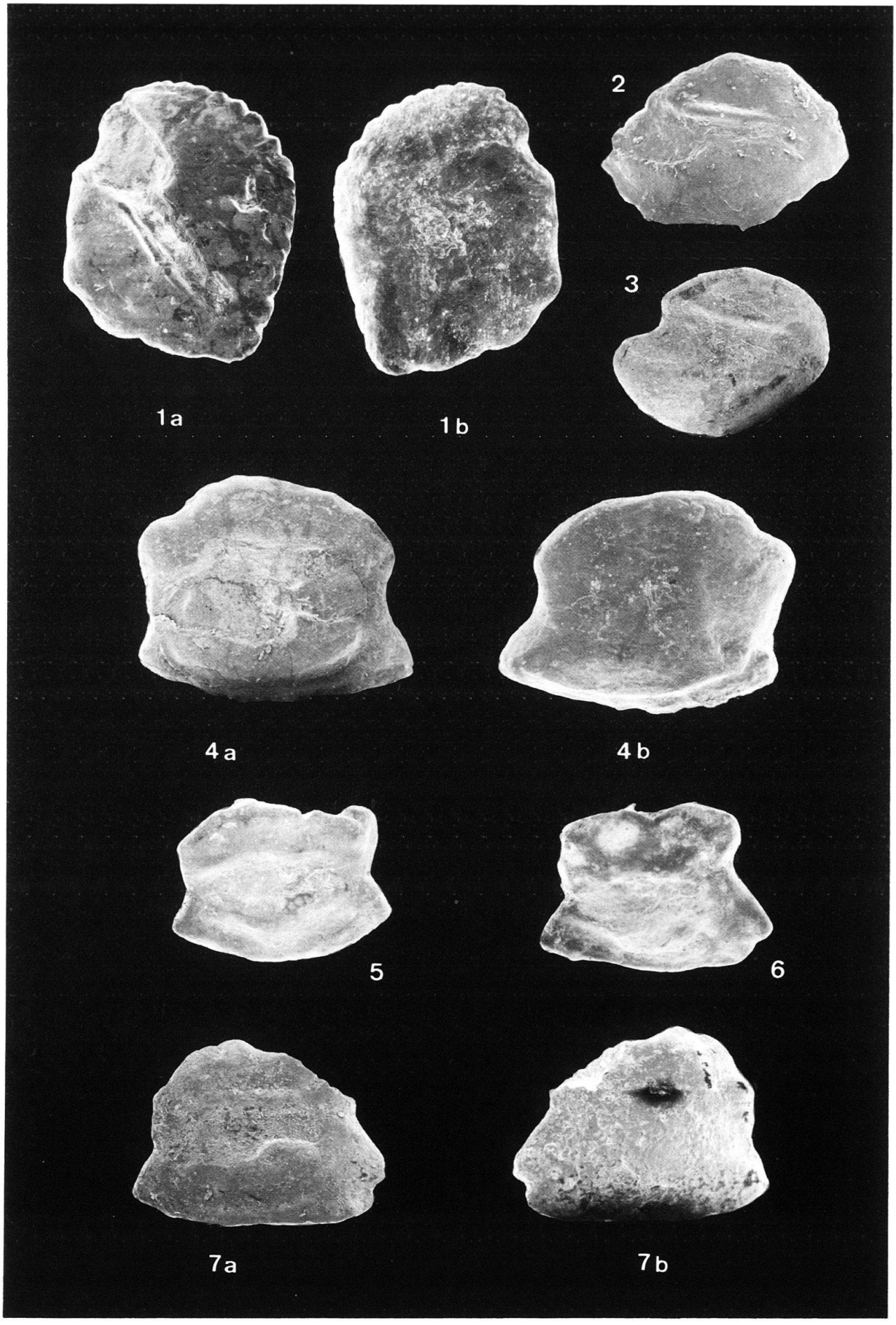
Fig. 5 *Gobius sectus* STINTON & KISSLING. A/I 814. ×15.

Fig. 6 *Gobius sectus* STINTON & KISSLING. A/I 815. ×25.

Fig. 7a, 7b *Gobius irregularis* (holotype). A/I 816. ×20.

All the specimens are in the collections of the Paläontologisches Institut der Universität Zürich, Künstlergasse 16, 8006 Zürich, and bear the registration numbers of that institution.

Photos: Helmut Franz, Geologisches Institut, ETH Zürich.


1a
1b
2
3
4a
4b
5
6
7a
7b