IDENTIFICATION OF FISH FROM THE SOUTHERN OCEAN BY MEANS OF OTOLITHS

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Abstract. The otoliths of 21 species of fish from the Southern Ocean are illustrated by photographs. They include otoliths from the demersal Nototheniidae and Channichthyidae, the midwater Myctophidae and other common nearshore fish species. The measurement of the otoliths and the size of the fish from which they are taken are also given.

Fish identification based upon external shape and structure of otoliths was feasible. Otoliths undergo morphological changes during the life-cycle of the fish. However, once the fish reach the adult stage there is relatively little change in shape and structure of the otolith, though there is a continuing increase in size as the fish becomes older.

Introduction

The annular growth rings in fish otoliths have been widely used for age determination. Age determination in Antarctic fish by means of otoliths has been outlined by North and others (1980), Townsend (1980), Freytag (1980) and Burchett (1983). However, there is little information available on fish identification based upon otolith morphology. Yukhov (1971) has illustrated the otolith structure of *Dissostichus* species. North and others (1983) have deduced fish sizes from otolith remains and Burchett (in press) has described otoliths of *Notothenia rossii marmorata* at different stages of development. We show here that it is possible to identify species and size of fish from otolith structure. Such identification is of increasing importance in the study of predator–prey relationships in the Antarctic ecosystem since otoliths are often all that remains of fish in faecal pellets or stomach samples from birds, seals and fish.

Otolith Material

Several species of Antarctic fish were caught and measured for total length (to the nearest millimetre) and total weight (to the nearest gram). Sagittal otoliths were removed from the fish, then dried and stored in labelled vials for subsequent analysis. The anterior–posterior (length in millimetres) and dorso-ventral (diameter in millimetres) planes of a sagittal otolith from each fish were measured with the aid of a binocular microscope fitted with an eyepiece graticule. Photographs of both internal and external surfaces were taken to show the characteristic features of the otoliths. Since otolith structure changes during fish development (Burchett, in press), wherever possible, otoliths were obtained to cover the various stages of the fish life-cycle.

The photographs (1–72) illustrate characteristic features of otoliths from various species of Antarctic fish. The key to the photographs with fish and otolith measurements are given in Table I.

The shape and outline of otoliths were found to be highly characteristic of the family. In closely related species, although otoliths show similarity, they are still

distinct in appearance, making possible fish identification from the external shape and structure of the otolith.

Otolith shape changes as fish become older. Fingerling fish tend to have spheroid otoliths which attain the characteristic form of the species during juvenile development. By the late juvenile stage, the fine detail of the otolith structure, such as crenulated surface and well differentiated sulcus is achieved. During the adult stage the otolith may increase in size as the fish grows older (Table I), although the basic features of otolith structure remain unchanged.

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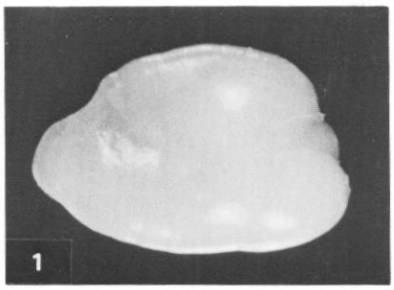
Table I. Key to photographs with fish and otolith measurements (F – fingerlings; J – juveniles; A – adults)

Photo no.	*Species*	*Fish length (mm)*	*Fish weight (g)*	*Otolith length (mm)*	*Otolith diameter (mm)*	*Fish stage*
1, 2	*Notothenia rossii marmorata*	82	6	1.33	0.83	F
3, 4	*N. rossii marmorata*	104	11	1.50	1.00	F/J
5, 6	*N. rossii marmorata*	316	423	3.50	2.33	J
7, 8	*N. rossii marmorata*	348	819	3.67	2.50	J
9, 10	*Notothenia neglecta*	260	280	3.67	1.83	J
11, 12	*Notothenia gibberifrons*	187	44	4.67	2.67	J
13, 14	*N. gibberifrons*	352	405	7.33	4.83	J/A
15, 16	*Notothenia nudifrons*	113	12	3.17	1.50	J
17, 18	*N. nudifrons*	142	29	4.17	1.83	J/A
19, 20	*Notothenia (T) hansoni*	176	45	3.33	2.17	J
21, 22	*N. (T) hansoni*	259	180	5.17	3.67	J/A
23, 24	*Notothenia angustifrons*	91	6	2.50	1.50	J
25, 26	*N. angustifrons*	127	19	3.50	1.67	J/A
27, 28	*Notothenia larseni*	171	61	4.50	2.17	A
29, 30	*Harpagifer bispinis*	78	9	2.33	1.33	A
31, 32	*Chaenocephalus aceratus*	540	1050	5.17	4.00	A
33, 34	*C. aceratus*	630	1900	5.67	4.00	A
35, 36	*Champsocephalus gunnari*	236	60	2.33	2.17	J/A
37, 38	*C. gunnari*	352	279	3.33	2.67	A
39, 40	*Pseudochaenichthys georgianus*	326	42	4.33	3.17	J
41, 42	*Parachaenichthys georgianus*	571	1290	5.33	3.50	A
43, 44	*Krefftichthys (P) anderssoni*	79	3	1.67	1.50	J
45, 46	*Muraenolepis microps*	109	8	2.33	1.33	J
47, 48	*M. microps*	320	238	4.50	3.00	A
49, 50	*Dissostichus eleginoides*	434	761	7.67	4.67	A
51, 52	*D. eleginoides*	940	8000	10.33	7.00	A
53, 54	*D. eleginoides*	1520	30000	14.67	8.83	A
55, 56	*Dissostichus mawsoni*	1405	30909	10.33	8.50	A
57, 58	*D. mawsoni*	1450	35000	9.50	7.33	A
59, 60	*Gymnoscopelus nicholsi*	156	25	5.17	3.00	A
61, 62	*Gymnoscopelus braueri*	70	2	1.50	1.13	J
63, 64	*G. braueri*	106	7	2.33	1.83	J
65, 66	*Protonyctophum bolini*	69	2	2.17	1.67	–
67, 68	*Electrona antarctica*	89	5	2.17	1.83	–
69, 70	*E. antarctica*	112	13	2.83	2.17	–
71, 72	*Electrona carlsbergi*	88	5	3.17	2.83	–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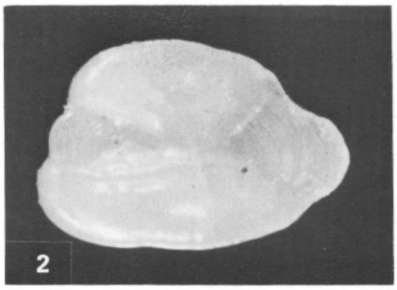
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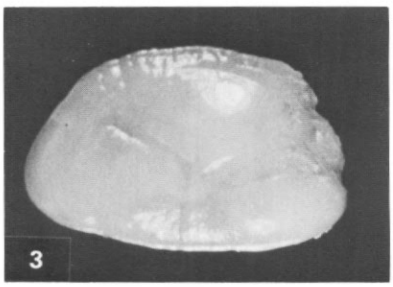
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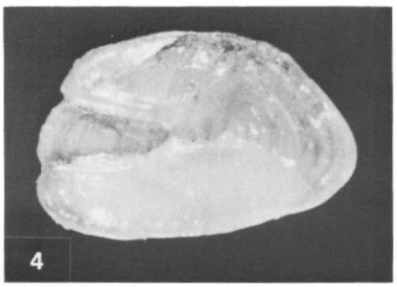
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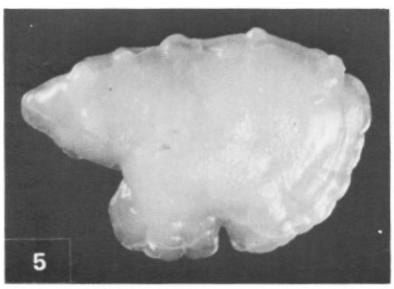
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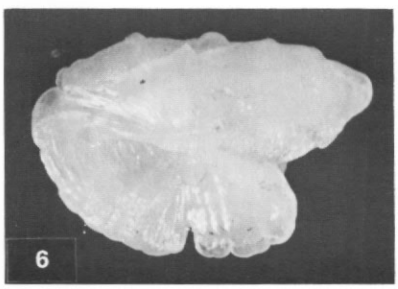
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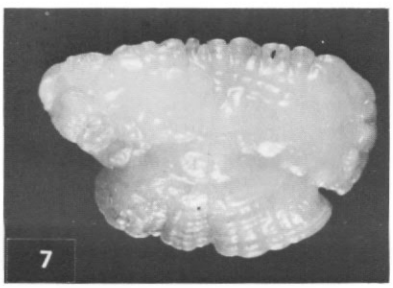
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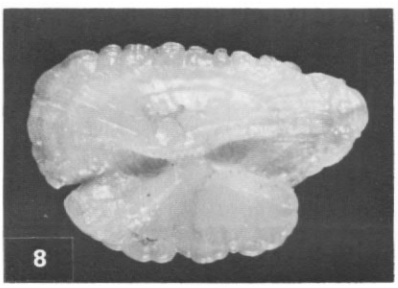
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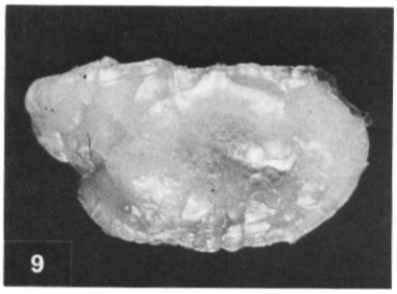
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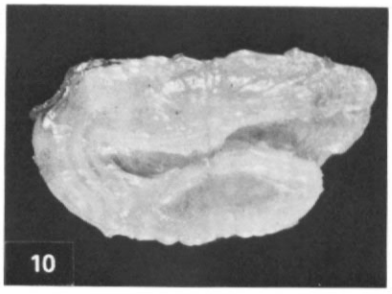
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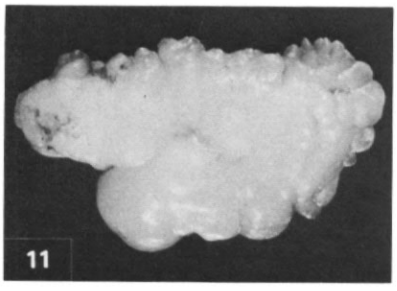
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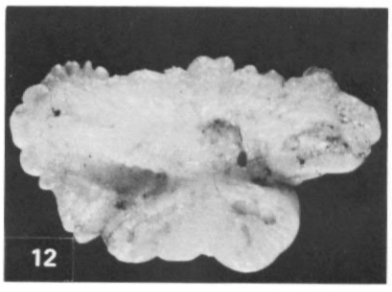
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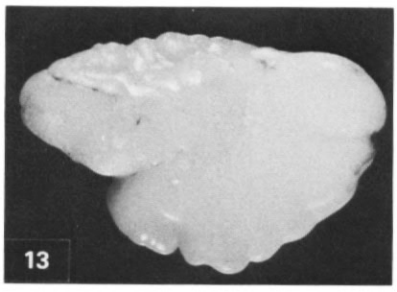
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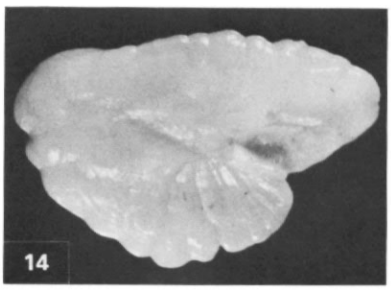
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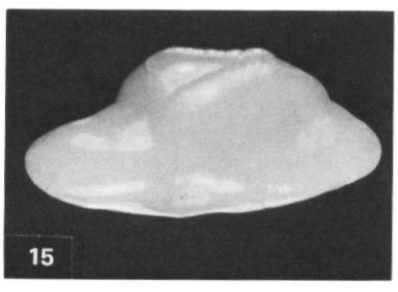
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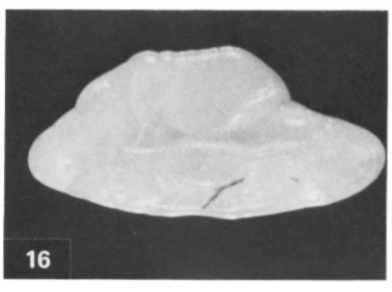
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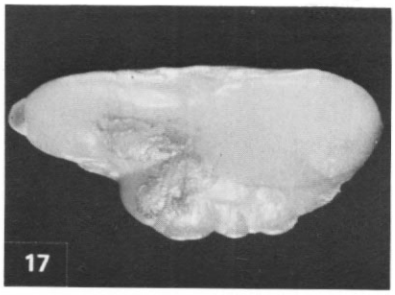
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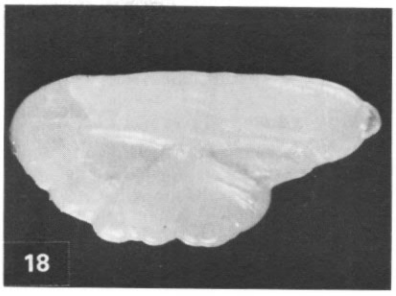
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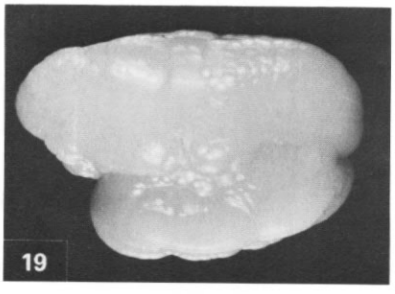
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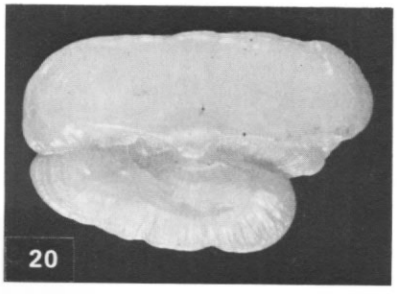
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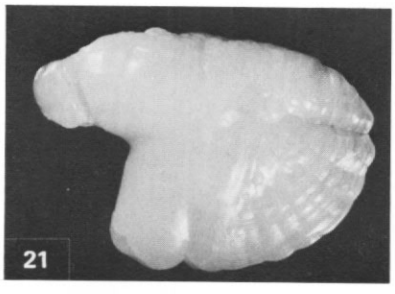
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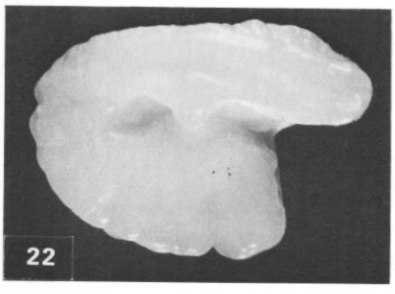
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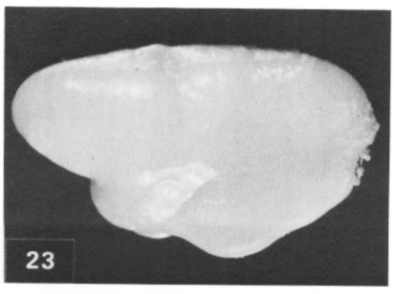
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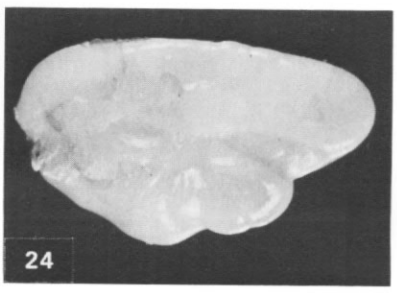
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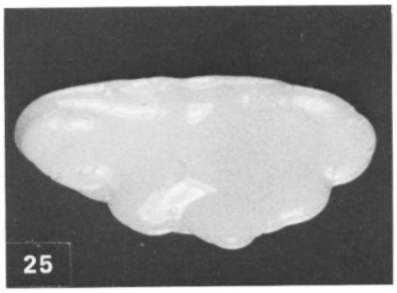
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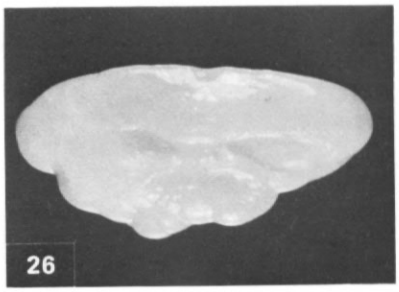
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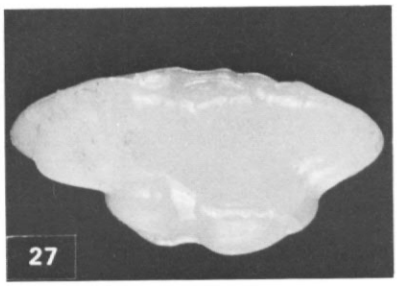
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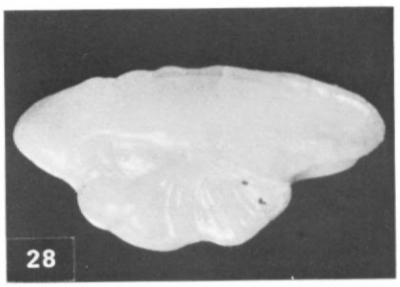
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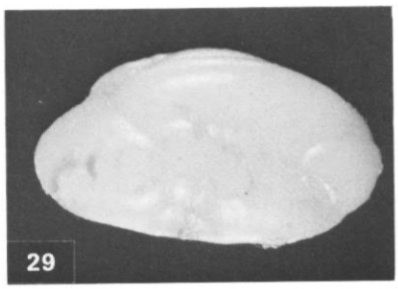
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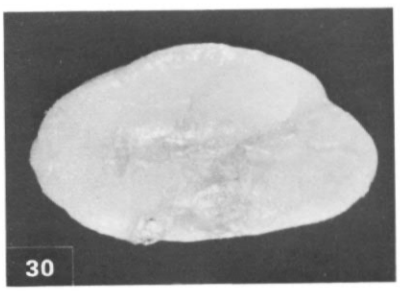
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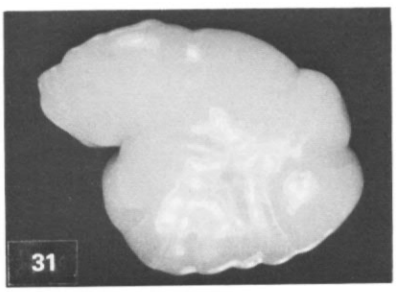
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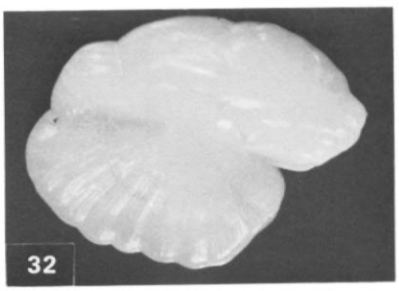
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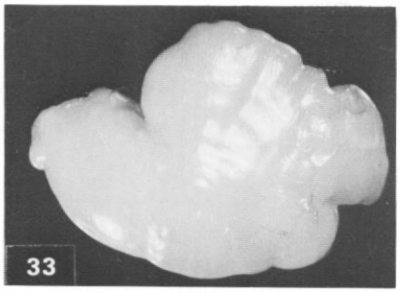
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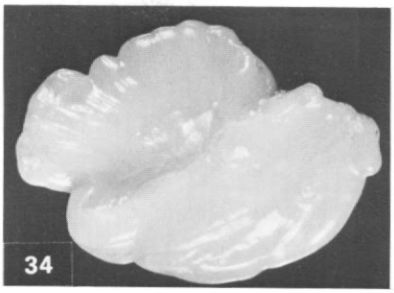
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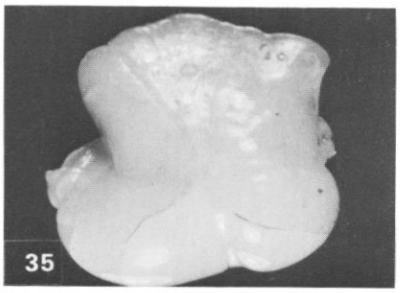
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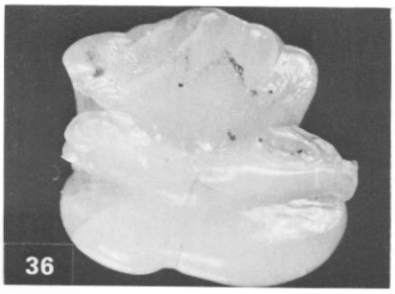
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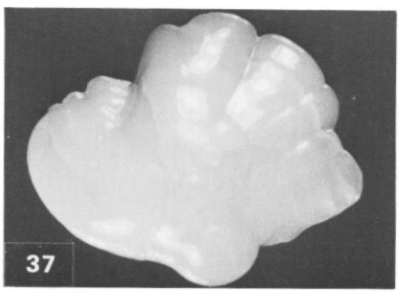
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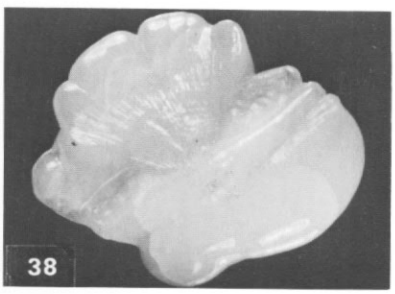
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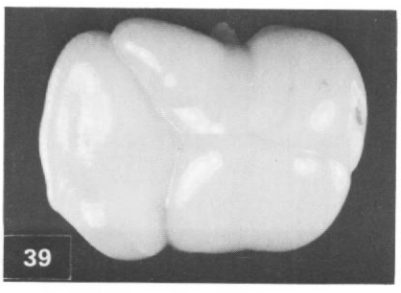
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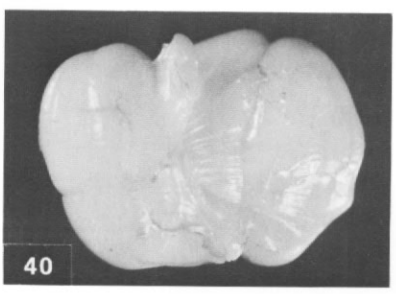
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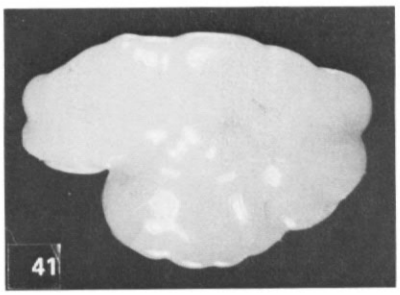
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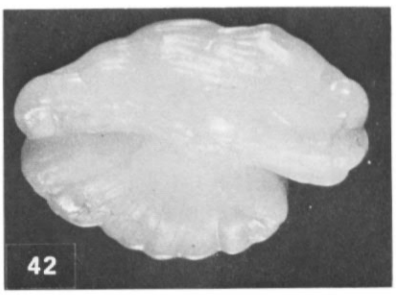
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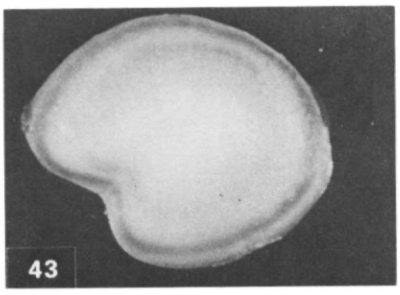
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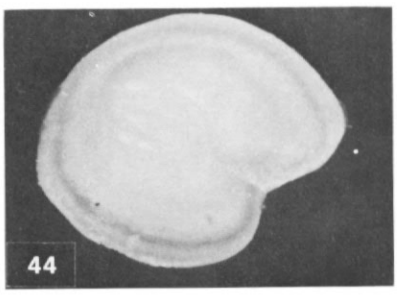
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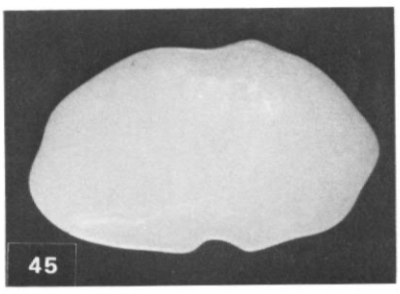
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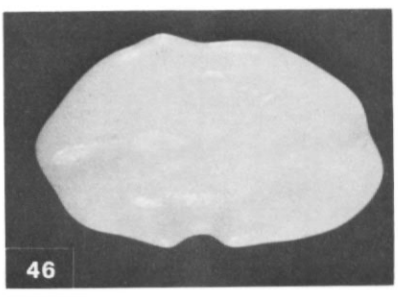
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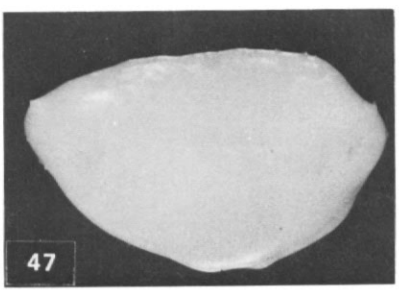
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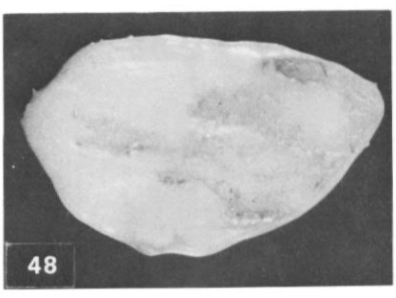
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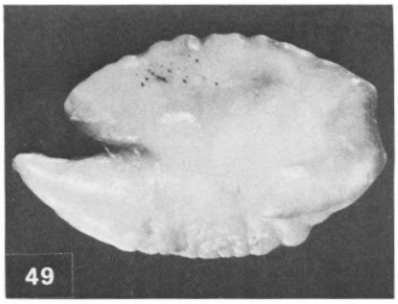
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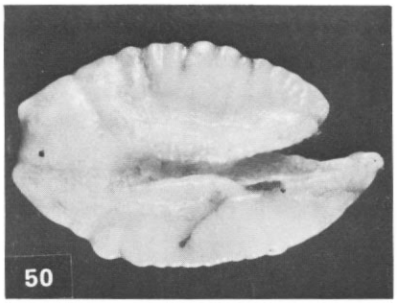
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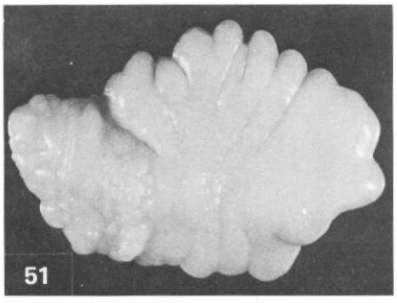
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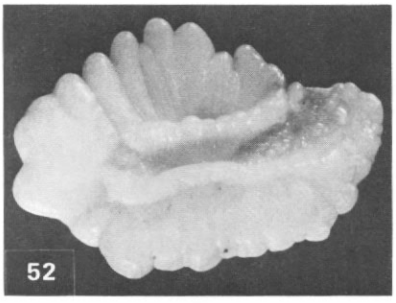
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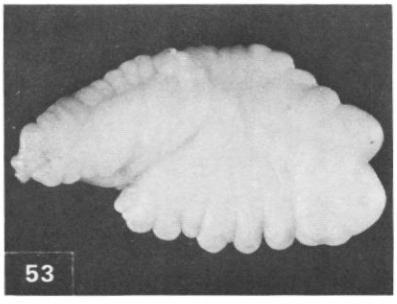
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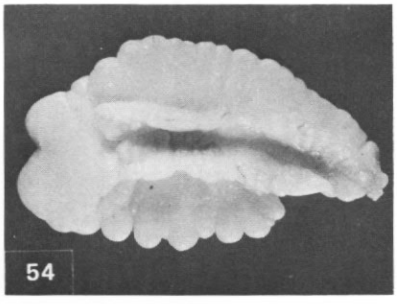
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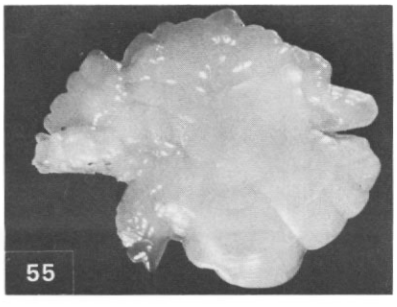
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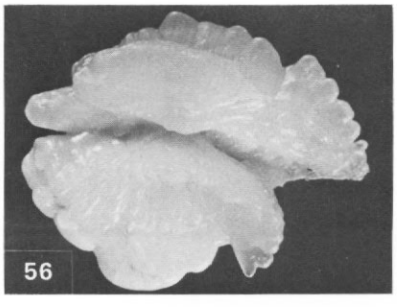
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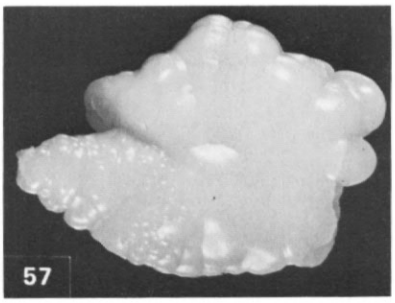
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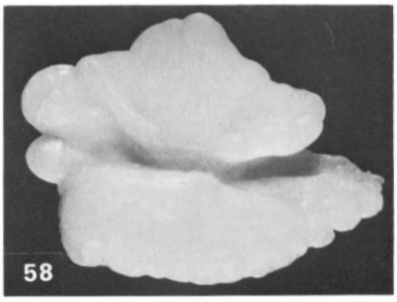
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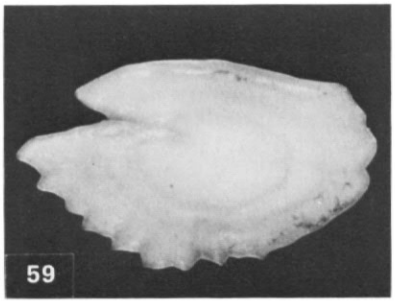
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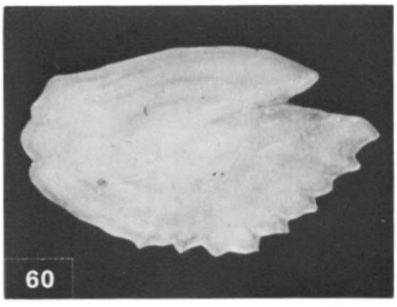
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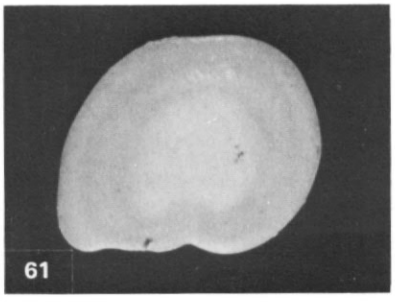
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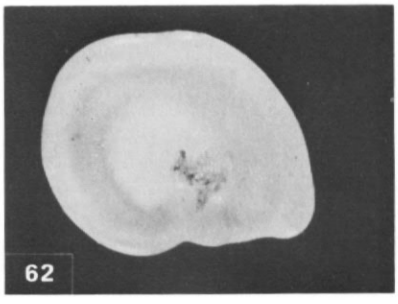
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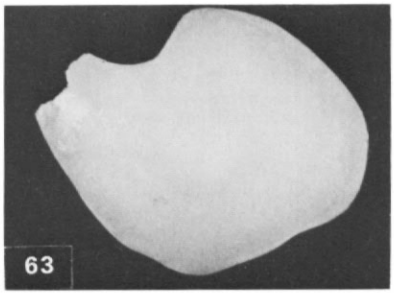
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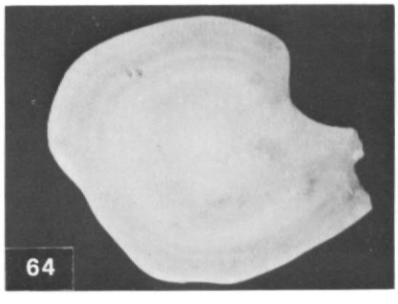
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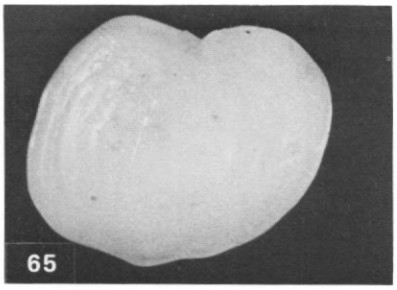
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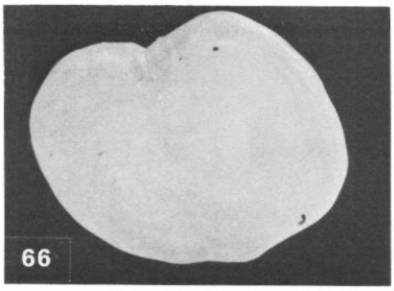
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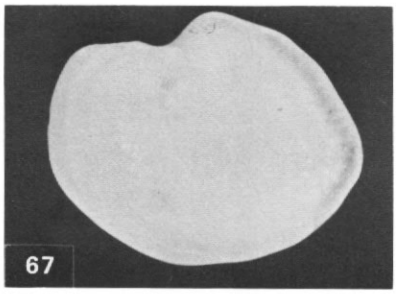
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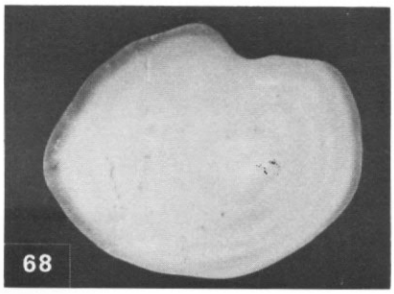
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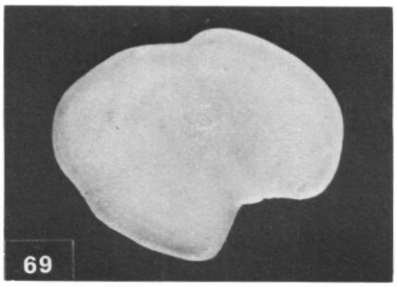
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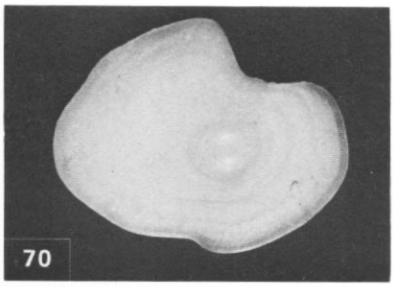
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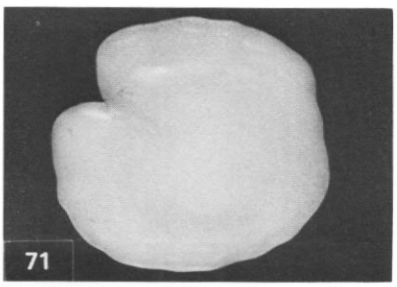
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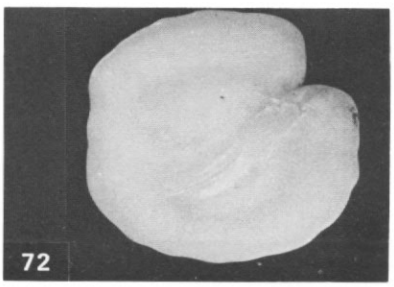
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