Astarte omalii peelensis n. ssp., Architectonica neerlandica n. sp. and Chrysallida andersoni n. sp. from the Miocene of the Netherlands and Western Germany

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In the Miocene deposits of the Peel region in the Netherlands about 1500 specimens of a species of *Astarte* have been found, which agree with the Pliocene *Astarte omalii* de la Jonkaire, 1823. Although some specimens perfectly agree with some juvenile Pliocene forms, the bulk of the material shows typical features, which consistently differ from those of the Pliocene form and its variations. I consider the Miocene form as a subspecies of *Astarte omalii,* for which I propose the name:

Astarte (Isocrassina) omalii peelensis nov. subsp.

Plate 1, figs. 1a, b (holotype) and figs. 5a, b (a paratype)

Astarte omalii de la Jonkaire, 1823, Heering, 1950: 20, pl. 3, figs. 49, 54 (paratype).

Astarte (Isocrassina) omalii de la Jonkaire, 1823, Anderson, 1964: 151-152, pl. 4, figs. 37a, b.

Astarte (Isocrassina) omalii peelensis nomen nudum, Zagwijn, 1968: pl. IV, figs. 12a, b.

Shell thick, convex, triangular in outline. The umbo lies in or a little before the midline, is very prominent and directed forward. Antero-dorsal and postero-dorsal margins of equal length. The anterior margin is very short and strongly curved, the curve always being stronger than in the Pliocene form. The posterior margin is obliquely truncate or broadly rounded; this margin is also shorter and more oblique than in the Pliocene form. Exterior as in the Pliocene form, but usually the concentric ribs at the umbo are fewer and finer than they are in Pliocene shells of about the same size. The umbo is mostly corroded, but when intact ten to twenty fine, regular, concentric ribs may be counted high on the umbo. In about one sixth of my material, however, the ribs are a little coarser and are visible as far down as the centre of the valve, where they fade away. The area is a little longer than the lunule. The former is long, narrow and a little concave, the latter broad and more deeply concave, but less concave than in the Pliocene form. Hinge and hinge-plate as in the Pliocene form, but the central hinge-plate, the cardinal teeth and their interstices are narrower, which is due to the small angle between both dorsal margins. The average angle between postero-dorsal and antero-dorsal margins is about 93° (measured on fifty specimens)

but varies from 85° to 106°. In *Astarte omalii* s.s. the average angle is 104° and varies from 95° to 114° (measured on fifty specimens from beaches in Zeeland). For measuring this angle the following lines have been taken: postero-dorsally the long, extended part underneath the ligament pit and antero-dorsally the line from the tip of the beak to the point of contact at the upper part of the crenulate anterior margin (*not* to the lower point of the lunule). Inner margin mostly crenulate, but smooth in one sixth of my material.

Measurements of holotype: length 15.3 mm, height 15.1 mm, thickness 5.5 mm. The largest specimen available is 22 mm long and 20 mm high; the bulk of the material is from 15 tot 18 mm long.

Holotype (Plate 1, figs. 1a, b), about 100 paratypes and 1400 other specimens: Baarlo (Peel region), boring no. 9, depth 100-160 m, Middle Miocene. Paratypes (Plate 1, figs. 5a, b): Oploo (Peel region), 'Flachbohrung 37', depth 54-58 m, twenty left and right valves, Upper Miocene, Zanden van Oploo (Grammer Stufe); Belfeld Station, 'Flachbohrung 20', depth 27.20-31.50 m, ten left and right valves, Upper Miocene (Grammer Stufe); Dingden, Western Germany, brook bank near the 'Königsmühle', four right valves, Middle Miocene (Reinbek/Dingden Stufe).

Typical specimens of this Miocene subspecies can be easily distinguished from Pliocene *Astarte omalii* s.s. by the following points: *Astarte omalii* s.s. has a maximum length of about 35 mm; the umbo is placed at about one third of the length and is strongly directed forward, much more so than in *Astarte omalii peelensis*; the umbo is less prominent; the area is twice as long as the lunule; the valves are longer; the index $\frac{\text{height}}{\text{length}} \times 100$ (see GLIBERT, 1945, pp. 4-5) for Pliocene *Astarte omalii* is 91.53 and for *Astarte omalii peelensis* 96.15, both calculated for fifty specimens.

Astarte omalii peelensis occurs from the Middle Miocene (Reinbek/Dingden Stufe, possibly from the Hemmoor Stufe) to the Upper Miocene. It is only common in boring no. 9 in the Peel region, in all other Peel borings, a total of 19 over the whole Peel region, this subspecies is absent in the Middle Miocene. It is rather common and widely distributed in the Upper Miocene of the Peel region. In the Middle Miocene some specimens are found to agree with some of the Pliocene *Astarte omalii,* in the Upper Miocene many intermediate forms occur together with typical *Astarte omalii peelensis* *).

*) During the last few years I have done a good deal of work on the Neogene species of *Astarte*. The first publication, dealing with the Pliocene *Astarte,* will appear this year, the next one, dealing with the phylogeny of the Neogene *Astarte,* will be published later.

Two new Miocene gastropods are described below.

Architectonica neerlandica nov. spec.
Plate 1, figs. 2a-c (holotype) and 3a-c (paratype)

Shell lenticular, with a sharp keel, twice as wide as high and of a very pale brownish-yellow colour. Protoconch smooth, planorboid, with $1^3/_4$ visible whorls, emerging from a small pit. The protoconch is not bordered by a varix, only a little lamella, curved forward, is visible against the preceding whorl. The teleoconch consists of $2^3/_4$ whorls, which increase rather slowly in width. A beaded spiral rib lies at the periphery of the whorls, which rib starts strongly at the protoconch, but becomes gradually weaker towards the aperture. The upper part of the whorls above this rib is flat and it starts horizontally, but as the spiral rib becomes weaker, this part of the whorls becomes more sloping. The part below the spiral rib is always concave and sloping, but near the protoconch more strongly than near the aperture. Near the aperture both parts of the whorl lie in the same inclined plane. A second spiral rib starts very weakly at the protoconch on the lower suture, but soon it becomes stronger and knobbed and eventually it forms a distinct, crenulate, sharp keel, which borders the shell.

The upper part of the whorls is ornamented by rather strong, somewhat irregular, oblique, imbricate, flat, transverse ribs. The middle rib is imbricately knobbed where it cuts across the transverse ribs. On the lower part, below the middle rib, the transverse ribs divide into fine irregular riblets, which reach the second spiral rib or keel, alternating with fine riblets, starting from the keel. A set of fine, regular, spiral lines covers all transverse and spiral ribs. In the lower part a smooth, concave, belt can be observed next to the keel, in which belt a somewhat stronger spiral line may be seen. The keel is covered with eight rather strong, uninterrupted, spiral lines over its whole width.

The base of the body whorl is concave near the keel and convex near the umbilicus. It is regularly covered with fine spiral lines, which vary a little in strength. A fine spiral rib, regularly crenulate, is situated close by the keel.

Very short, but strong, transverse ribs are present around the umbilicus, which ribs form strong knobs around the umbilicus. At the other end these ribs disappear rather suddenly, fading away into fine radial lines, which reach the keel. A fine network may appear in the part where these are as fine as the spiral lines.

The umbilicus is wide and occupies about one third of the total

width. The inner wall carries fine, irregular, transverse lines, connecting the coarse knobs of the basal wall with the fine knobs of a weak rib, lying deeper inside the umbilicus. There is a small concave belt between this weak rib and the preceding whorl in the umbilicus. The part of the protoconch inside the umbilicus consists of a nucleus and three smooth and quickly increasing whorls. Here the protoconch is bordered by a fine, sharp lamella.

Aperture broken, about trapezoid, sharply edged at the keel, rectangular at the umbilicus.

Measurements of holotype: major diameter 7.2 mm, height 3.5 mm, visible width of the protoconch 1.1 mm, major diameter of the umbilicus 2.7 mm.

Holotype: Beeringen, boring no. 15, depth 119-124 m, Middle Miocene (Hemmoor Stufe). Paratype (juvenile): Dingden (Western Germany), brook bank near the 'Königsmühle', Middle Miocene (Reinbek/Dingden Stufe).

Only two specimens are available, but the species is sufficiently characteristic, so that its description as a new species seems justified.

Chrysallida andersoni nov. spec.

Plate 1, figs. 4a, b, holotype

?*Alvania* spec., Anderson, 1964: 201, pl. 13, fig. 106.

Shell dextral, conical, twice as high as wide. The angle of the apex is 40°. Protoconch heterostrophic, depressed and consisting of one smooth, round whorl, which emerges from the interior. The teleoconch consists of $4^3/_4$ nearly flat whorls, divided by a deep suture. The last whorl occupies about five eighths of the total height and is obtusely, but distinctly, edged at the periphery. The sculpture consists of distinct straight, oblique, ribs, parallel to the right margin of the shell. The first whorl has about fifteen ribs, the body whorl about twenty. At the base of the shell the ribs gradually disappear and are not visible beyond the narrow furrow of the umbilicus. The ribs are as wide as the intercostal spaces. A faint, irregular, spiral sculpture can be observed on the entire shell, most clearly at the base. A somewhat stronger spiral furrow lies a little above the keel at the periphery or above the lower suture at the other whorls. A small rounded belt occurs on the highest part of the whorls, next to the upper suture. On this belt the spiral lines are more distinct and each axial rib forms a knob on this belt. The ribs also form weak knobs on the weak spiral line on the periphery.

The aperture occupies about three eighths of the length and is oval, with acute apex. A weak tooth can be observed on the columella, deeply situated just above the nearly closed umbilicus.

Measurements of the holotype: height 3.5 mm, width 1.8 mm.

Holotype: Beeringen (Peel region), boring no. 15, depth 119-124 m, Middle Miocene (Hemmoor Stufe). Paratype (described and figured by ANDERSON as *Alvania* spec., see above) Dingden (Western Germany), brook bank near the 'Königsmühle', Middle Miocene (Reinbek/Dingden Stufe).

The holotypes have been preserved in the collection of the Geological Survey, Haarlem. Twenty paratypes of *Astarte omalii peelensis* have been deposited in the Rijksmuseum voor Geologie en Mineralogie, Leiden and another twenty in the Natural History Museum, Rotterdam. The latter collection also contains the paratypes of *Architectonica neerlandica* and *Chrysallida andersoni* (cat. no. 1843).

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Plate 1. Figs. 1a, b, *Astarte omalii peelensis* n. subsp., holotype (3 ×), boring no. 9, Baarlo (Peel region), depth 100-160 m, Middle Miocene; figs. 2a-c, *Architectonica neerlandica* n. sp., holotype (6 ×), boring no. 15, Beeringen (Peel region), depth 119-124 m, Middle Miocene; figs. 3a-c, do., paratype (6 ×), Dingden (W. Germany), brook bank near the 'Königsmühle', Middle Miocene; figs. 4a, b, *Chrysallida andersoni* n. sp., holotype (10 ×), boring no. 15, Beeringen (Peel region), depth 119-124 m, Middle Miocene; figs. 5a, b, *Astarte omalii peelensis* n. subsp., paratype (1½ ×), 'Flachbohrung 37', Oploo (Peel region), depth 54-58 m, Upper Miocene.

PLATE 1
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