THE ALMOND WHELKS OF THE CRAG

In his 'British Conchology' (London, 1867) John Gwyn Jeffreys informs us that Neptunea antiqua was sold at Billingsgate, London, under the name of 'almond' or 'red whelk'. For the lower working classes the foil (liver) was stated to be 'more fat and tender than lobster.' In 1872 Searles Valentine Wood (in First Supplement to his 'Crag Mollusca') writes of the fossil Neptunea contraria as the 'Left-handed Almond Whelk'. In 1970 Neptunea antiqua was the culprit in food-poisoning in Fife, Scotland, with the toxin Tetramine (tetramethyl ammonium hydroxide) occurring in its salivary glands and elsewhere.

The term Neptunea was introduced by Peter Friedrich Röding in 1798 in 'Museum Boltenianum.....' Hamburg (ex Bolten MS) centred on Murex antiquus of Linnaeus, now known as Neptunea antiqua. The term Chrysodomus was introduced by William Swainson in 'A Treatise on Malacology' 1840, London, and is occasionally seen instead of Neptunea in literature. Neptunea is a fusiform gastropod shell — spindle-shaped, thickest in the middle and tapering towards both ends. It has well developed spiral sculpture and lacks strong axial rib sculpture and any reticulate ornament. Growth lines on upper part of whorl become prosocline — — directed towards suture (meeting with next whorl) at an angle which is obtuse towards the aperture. Neptunea is characteristic of Northern Hemisphere arcto-boreal inshore benthic fauna.

Neptunea originated and evolved in waters of the northern Japan-Sakhalin area during Oligocene-Miocene times. A number of species are recorded from the Late Miocene of Kamchatka, e.g. N. pluricostulata Ilyina and N. unicostulata Ilyina and by Late Pliocene times N. tabulata (W. Baird, 1863) had reached California. There are still several living Japanese species including N. laeva, a sinistral species in the Sea of Okhotsk (Zool. Zhur. 1987). With the shoaling of the Panamanian seaway between North and South America during Pliocene times, marine flow became northwards through the Bering Straight dispersing Pacific Neptunea stocks across the Arctic (e.g. N. clenchi A.H. Clarke 1956 — ?related to N. despecta — in East Canadian Arctic areas and the Barents Sea) and into the North Atlantic where new stocks originated and dispersed. In the Western North Atlantic an example is

N. decemcostata (Say, 1826), found in the Pleistocene Maine-New York and living Nova Scotia to Massachusetts (it is the Massachusetts State Shell) and recorded off North Carolina. Stocks occupied the Pliocene and Pleistocene basins of Iceland and the North Sea, our Crag recording major changes in the ecosystem, and expanded into the western Mediterranean during the Pleistocene. Examples of living species are the dextral N. antiqua (Linnaeus, 1758), 'Ancient Neptune', found around the British Isles and in the North Sea, and the sinistral N. contraria (Linnaeus, 1771), Contrary Neptune, occurring from the S. Biscay Bay coast of France to Cape Spartel, Morocco.

There are a number of early records of fossil 'Contrary Neptunes'. One is illustrated in Samuel Dale's History of Harwich in 1730, pointing out that it – the reversed whelk of the sands (Crag) – was not found living in the adjacent seas and that the deposit was (therefore) not recent. In 1788 an anonymous letter in the Gentleman's Magazine (vol. lviii, p. 321) noted the fossil shells in Felixstowe cliff – "Upon the coast of Suffolk, from the high cliff (which we descend to Landguard Fort) to Bradsey (sic) Ferry, the cliff is a composition of marine shells, among which are found a great number of the spiral wilk-shells. Time, and the want of an animated inhabitat, has given them a yellow coat; but they are exactly the same, as to size and form, with the life-shell on the beach beneath, with this very singular difference that every shell in the cliff has its spiral turn contrary (plate ii, fig. 4) to that of the life-shell (fig. 5). We call the yellow ones ante-diluvians." Another whose attention was called by the crag deposit was Samuel Arnold Mackay, born at Haddiscoe, Norfolk 1765, died Norwich 1843. He was apprenticed to a shoemaker at Walton in Suffolk, and in his endeavour to account for the sinister turn of the Crag whelks he was led to contemplate those systems of cosmogony which ascribed a greater antiquity to the Earth than the then current notion of 6,000 years.

Dextral and sinistral (contrary) Neptunes are illustrated (as Murex) in James Sowerby's Mineral Conchology. In volume 1 (1813) Murex striatus is shown on plate 22, two of the specimens being from Holywells, Ipswich, with Murex contrarius on plate 23. In volume 2 (1818) Murex striatus variety carinatus is recorded on plate 109 [Note – of 5 specimens on this plate, Neptunea is certainly 1 and Nucella is 3. In Neptunea the protoconch (larval shell, demarcated from the teleoconch – rest of shell), when present, distinguishes juveniles from Nucella. Also, the outer lip of the aperture is simple in Neptunea, generally crenulated or sharp in Nucella].

Sinistral Neptunea in the Crag —

- Searles Wood figured this as Trophon antiquum variety contrarium in his 1848 Monograph, with the following variations –
  - plate 5, fig. 1g – var. contrarium striatum – 'striated variety, so common at Walton-on-the-Naze.'
  - fig. 1i – var. c. sinistrorsum G.P. Deshayes 1830 (Encyclopedie Methodique), a S. Europe-Mediterranean species.
  - fig. 1j – var. c. elongatum – 'Belgian shell, canal more produced than in English specimens, and pointed at the apex, a character not seen in Searles Wood's specimens.'
  - fig. 1k – var. c. carinatum – 'carinated variety from Bridlington, Yorkshire.'
  - fig. 1h – var. angulatum.
  - Searles Wood's specimens – 'many much rubbed or eroded; traces of striae could be detected; none quite smooth.' (figs d, e, f are 'Trophon antiquum contrarium.'
- In his 1857 Appendix to part 2 Wood figured (woodcut, pp. 327-328) Trophon antiquum var. contrarium planorbulum, a 'deformity' from Red Crag of Sutton.
- In Searles Wood's First Supplement (1872) he grouped figures 1 d-g, i, j of 1848 as Trophon antiquus var. striatus contrarius, found in Red Crag and Norwich Crag ('Fluvio-Marine Crag' and 'Chillesford Beds') and at Weybourne. He also figured (10a, b, c) Trophon antiquus carinatus contrarius from the Crag – 'exhibits three ridges or carinae upon the upper volution and are continuous over the body whorl.'
- In 1898 Frederic Harmer (Proc. International Congress Zool.) gave figures of Neptunea contraria –
  - fig. 1 – var. sinistrorsa from Pliocene of Sicily – 'spiral markings close together on upper whorls and on the body are divided by a fine thread.'
  - figs. 2 and 3 – from Scaldisian of Belgium – 'principal spiral ridges are more prominent, are further apart and are separated by a number of fine ones of unequal size; the canal is longer than in the Sicilian fossil.'
  - fig. 4 – Recent, from Vigo Bay – 'spiral markings intermediate between Belgian and Sicilian forms.'
  - fig. 5 – from Little Oakley, Essex – 'sculpture similar to nos 2 and 3 but striations are feeble and canal is much shorter.'
- Frederic Harmer figured more in his 1914-1919 Monograph –

  Neptunea contraria
  - plate 16 – var. typica, 1-Little Oakley, 2-Antwerp.
    - var. sinistrorsa, 3-Little Oakley, 4-Sicily: 'spiral striation finer than var. typica, generally more graceful and slender; some Recent specimens of an intermediate character.'
    - var. angulata S.V. Wood, 7-Waldringfield (in Norwich Castle Museum).
    - var. carinata, 5-imperfect shell from Little Oakley: 'agrees with Searles Wood's var. sinistrorsum; in this from the upper

part of the last whorl is rounded and not shouldered.'

-var. informis nov, 6 - Little Oakley: 'short variety; approaches in form the Recent and arctic species N. deformis Reeve' (N. (Pyrulofusus) deformis found in Spitzbergen, Nova Zembla, Bering Sea).

-not identical, but possibly related

-plate 36, fig 30 - Bramerton, 31 - Wexford: 'short spire and expanded body whorl' [fig 30: British Museum specimen].

-plate 37, fig. 3 - 'Corallina Crag Boyton (York Museum)'.

4 - var. carinata: Bridlington (Cambridge Museum).

5 - var. carinata: Antwerp

- Glibert (in literature)

-refers plate 16, figs 5, 6, 7 of Harmer to N. contraria var. deformis.

Dextral Neptunea in the Crag -

- Searles Wood figured this as Trophon antiquum (and then T. antiquus) in his 1848 Monograph; specimens were recorded from the Red Crag and Norwich ('Mammaliferous') Crag. There were dextral and sinistral (see Neptunea contraria) varieties. The dextral were then figured as striated and carinated varieties, becoming striatus Sowerby and carinatus Lam. in Wood's 1882 Third Supplement. Also included in this Supplement were figured (fig. 9) Trophon antiquus var. despectus from the Red Crag of Sutton, and (fig. 8) N. berniciensis? from Norwich.

- In 1898 (Proc. International Congress Zool.) Frederic Harmer figured -

-fig. 6 - N. antiqua var. carinata from Little Oakley: 'over 50% Oakley shells carinated.'

-fig. 7 - N. antiqua, typical, from Little Oakley: 'suture more nearly at right angles to the columella and whorls overlap, so spire is very short.'

- Frederic Harmer figured 18 different Crag forms in his 1914-1919 Monograph. 'N. despecta' has 5 varieties based on other species and 5 new varieties; N. antiqua has var. typica, one variety based on Searles Wood's work and two new varieties; N. ventricosa and N. castanea are previously described species; two new species are featured.

Neptunea despecta (Linné 1758) - plate 17 fig. 1: Little Oakley.

-var. decemcostata Say 1825: 'strong ribbed': 17 (3) Little Oakley, and (4) Bramerton; plate 25 fig 3 Bramerton, fig. 5 Little Oakley: [25(3) a dwarf form, with finer sculpture].

-var. carinata Pennant 1777: 'more slender and elongate': 17(5) Little Oakley, and 25(4) Little Oakley.

-var. subantiquata Maton and Rackett, 1807: 'sharply keeled shell': 17(7) Little Oakley and (6) Recent, Polar Seas; 25(2) Bramerton.

-var. behringiana Middendorff, 1849: 'short spire and banded sculpture': 17(8) Little Oakley.

- var. cobboldiae nov.: 'short spire, not carinated': 18 (8 and 9) – both Butley: 'dedicated to memory of the late Mrs Cobbold, from whom it was originally received; name striata used for a different shell.'
- var. intermedia nov.: 'traces of ridges on upper whorls': 17 (2) Little Oakley.
- var. pumilio nov.: '? abnormal variety': 18 (1) Bramerton, (2) ? Bramerton.
- var. intersculpta (G.B. Sowerby 1899): 'stronger spiral ridges not so prominent and intermediate ones are coarser': 26 Yarn Hill; 19 (5) Recent, Bering Sea.
- var. curtispira nov.: 'spire short and conical': 18 (6) Bramerton.
- var. subspitzbergensis nov.: 19 (4) Butley, (5 and 6) Little Oakley.

Neptunea antiqua (Linné 1758)

- var. typica: (very rare in Crag): 19 (1) Newbourn
- var. striata S.V. Wood: 19 (7) Sutton, (8) Thorpe Norwich, (9) Bramerton, (10) Butley.
- var. subtornata nov.: '? intermediate between antiqua and despecta; absense of distinct keel.' 19 (2 and 3) Butley.
- var. icenica nov.: 'slender form and narrow aperture': 19 (11) Easton Bavents.

Neptunea ventricosa (Gray, 1839): 23 (20) Felixstow.

Neptunea castanea (März 1857): 23 (7) Felixstow.

Neptunea ignota sp. nov.: 24 (16) Postwick: '? part of castanea group.'

Neptunea tenuistriata F.W. Harmer: 37 (1) Recent, Newfoundland, and (2) Bridlington; 46 (13) Hollesley.

Neptunea from Wexford, Ireland (in F.W. Harmer).

N. antiqua (Linné): 36 (26) Wexford

Left handed shells, Wexford

- differ from informis in sculpture, in their more slender character, non-ventricose body whorls narrower and non-expanded mouth and longer canal.

36 (27) var. inversa nov.: Wexford.
(28) var. inversa: Recent.
(30) var. informis F.W. Harmer: Bramerton
(31) var. informis: Wexford.

N. despecta (Linné) var. tornata (Gould)
36 (29): Wexford: carinate group.

- F. Strauch, 1972
  - united dextral fossils into one species – Neptunea lyratodespecta Strauch (from 'N. lyrata of Alaska' and 'N. despecta of Iceland')
  - N. lyratodespecta lyratodespecta (fig. 14-16)
    - var. anglica (fig. 16): slightly carinated shell: Red Crag Brightwell.
  - N. lyratodespecta striata (Sowerby): Holywells, Ipswich.

- R. Marquet, 1997.
  - Neptunea striata lyratodespecta Strauch 1972
    - fig 7(4) 1997.
    - whorls angular rather than rounded
    - aperture broad, nearly semicircular oval
    - ornament: 4-6 strong primary ribs on last whorl.
  - Neptunea striata striata (J. Sowerby 1813)
    - fig 7(5) 1997.
    - whorls rounded. (rather slender)
    - aperture smaller and narrower
    - ornament: 4-6 unclear primary spirals on last whorl.

- Neptunea antiqua
  - varieties of Recent shell: J.G. Jeffreys 1867
    - var. alba: - very large; very finely striated.
    - var. ventricosa: - thinner, the aperture often greatly expanded
    - var. striata: - elongate, with strong spiral striae, especially on the upper whorls.
    - var. gracilis: - slender, thinner, and spirally ridged.
  - typical form a comparatively small shell.

- (Miscellaneous note)
  - '-Neptunea antiqua: elongate spire and inconspicuous spiral sculpture.'
  - '-Neptunea despecta: strongly carinated forms, usually shorter in the spire, wider in proportion to length: (northern seas).'

- Comment on S.V. Wood 1848 Monograph -
  - Purpura lapillus var. angulata, 4(6e)
    - Neptunea despecta var. pumilio (in Harmer Monograph)

Comments on Wood's 1872 Supplement -
- Trophon ventricosus 3(4)
  - see N. ventricosa & N. tenuistriata in Harmer's Monograph

Comments on Wood's 1882 Supplement - [if fig 8, berniciensis a new sp, suggest woodwardii (Harmer: Monograph)]
- Trophon antiqua var. despecta (fig. 9)
  - Neptunea despecta var. decemcostata (in Harmer's Monograph)
  - Neptunea lyratodespecta (in Strauch)

Comments on Harmer's 1898 article -
- antiquus (fig. 7)
  - Neptunea despecta var. intermedia (in Harmer Monograph)
- antiquus var. brevispira (fig 8)
  - Neptunea despecta var. behringiana (in Harmer Monograph)

Comments on Harmer's Monograph

- Neptunea despecta 17(1)
  - N. antiqua: - Clifford Nelson & Thomas Pain 1986 Zool. J. Linn. Soc.
- var. decemcostata
  - N. antiqua: - Nelson & Pain. - N.s. lyratodespecta: - R. Marquet.
- var. carinata
  - N. antiqua: - Nelson & Pain. - N.s. lyratodespecta: - Marquet.
- var. subantiquata
  - N. strìata lyratodespata: - Marquet.
- var. behringiana
  - N. antiqua: - Nelson & Pain.
- var. cobboldiae
  - N. antiqua: - Nelson & Pain.
- var. intermedia
  - N. antiqua: - Nelson & Pain. - N. strìata strìata?: - Marquet.
- var. intersculpta
  - N. antiqua: - Nelson & Pain. - N.s. lyratodespecta: - Marquet.
  - (Bering Sea specimen: - var. carinata: - Glibert)
- var. curtispira
  - N. antiqua: - Nelson & Pain. - N.s. lyratodespecta: - Marquet.
- var. subspitzbergensis
  - N. antiqua: - Nelson & Pain (referred to as var. curtispira).
- Neptunea antiqua
- var. typica
  - N.s. strìata: - Marquet
- var. strìata
  - N.s. strìata: - Marquet
- var. subtornata
  - N.s. strìata: - Marquet
- Neptunea castanea
  - N. antiqua: - Nelson & Pain.
- Neptunea (Wexford)
  - var. inversa
  - var. informis

  } - sinistral N. antiqua: - Nelson & Pain.

(Thus several varieties and species identified with other authors species are dismissed as such by Nelson & Pain or Marquet, or all).

Almond Whelk Miscellania —

- Professor Percy F. Kendall stated that whilst dextral Neptunea in the Crag were often covered with barnacles he had never noticed any on a sinistral one. Frederic W. Harmer then reported that he had found them occasionally on the latter, but very rarely. In more recent times a temporary excavation at Bucklesham yielded numerous examples of sinistral Neptunea with adhering barnacles.

- some sinistral specimens in the Newbourn area are exceptionally large, up to seven inches recorded.

- Neptunea have two types of shell material — an outer layer of relatively solid calcite and an inner one of more chalky-looking aragonite. The calcite survives when most other shells have been dissolved away in our sandy soil, and such found at Playford, Washbrook and Sudbury are lonely reminders of the former extent of the Red Crag sea.

- The Contrary Neptunea whelk is a very popular fossil to publicise your group. Walton-on-the-Naze museum have used it on badges and the East Midlands Geological Society (!) on their information leaflet

The Sinistral Neptunea of the Crag: where did they come from? —

– there is a sinistrally coiled whelk, Pyrolofusus deformis (Reeve, 1847) living in Arctic Seas, but it is quite different from our Crag shell. Sinistral Neptunea have not (to my knowledge) been recorded from the Pliocene of Iceland.

Did speciation happen in the North Sea in response to a new environment, or

were they better at surviving attacks by right-handed crabs?

The Red Crag sinistral Neptunea had been fossils for perhaps a million years when sinistral Neptunea again entered our area, represented by specimens in the Weybourne Crag of Norfolk and the Wexford Gravels of Ireland, variously referred to N. contraria, N. informis and, more recently, N. inversa. Was this further local speciation or did climate change displace separate species into the North Sea from Arctic regions?

Spiral Ribs ornamentation

– are used to distinguish sub-genera, species, and changes in time. Some have equal spiral ribs, others show definite primary, secondary and tertiary ribs. The trend in time in Belgian sinistral Neptunea is from unequal spiral

ribs to less distinct.

What should we call our Neptunea species?

- using rib notation, those with equal ribs are Neptunea s.s., those with primary ribs Sulcosipho.
- DNA studies help with population and kinship analysis, as e.g. with the Japanese 'N' arthritica.
- populations have their own characteristics, as shown by 'average specimens'; exceptions may overlap variation of related species.

- in 1973 C.P. Nuttall selected a 'N. contraria' shell from the Red Crag of Sutton (British Museum, Natural History, specimen G 1719/1) as the lectotype of Neptunea angulata. The Crag shells have distinct orders of spiral sculpture, unlike the living N. contraria with relatively equal spiral ribs. I was unhappy about this 'new' name for our sinistral Neptunea as it was elevating Searles Wood's varietal name to species level, which did not cover all those varieties meant by Wood. However, Belgian and Dutch authors in Cainozoic Research July 2014 stated this name to be invalid according to article 45.4 of ICZN 1999. They then put forward Neptunea angulata of Harmer 1914, plate 16, fig. 7 (name valid under the Zool. Code) as the new name, with this specimen being from the Red Crag of Little Oakley and in Norwich Museum. This was corrected in Cainozoic Research December 2014, as pl. 16 fig. 5 was figured by mistake, pl. 16 fig 7 actually being from the Red Crag of Waldringfield, also in Norwich Museum. Norwich Crag and Weybourne Crag specimens, with no secondary spirals, are assigned to N. inversa (with N. informis being an invalid name).

Do we need new names for the Crag Neptuneas? James Sowerby's N. striata still stands for the dextral form(s) but its original locality could perhaps be used as N. holywellsia. For the sinistral form (the Crag 'contraria', N. angulata) perhaps N. antediluvia (after Anon of 1778).

[ICZN: International Commission on Zoological Nomenclature]

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R. Markham.