

July, 1964

63 B 15

PROCEEDINGS
OF THE
ROYAL IRISH ACADEMY

VOLUME 63, SECTION B, No. 15

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THE MOLLUSCA OF THE WEXFORD GRAVELS (PLEISTOCENE),
SOUTH-EAST IRELAND



DUBLIN :
HODGES, FIGGIS & CO., LTD.

1964

Price Four Shillings and Sixpence

Biologische Anstalt Helgoland
Bibliothek

THE MOLLUSCA OF THE WEXFORD GRAVELS (PLEISTOCENE),
SOUTH-EAST IRELAND

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(Communicated by A. Farrington, M.R.I.A.)

[Received 9 AUGUST, 1963. Read 10 FEBRUARY, 1964. Published 7 JULY, 1964.]

(PLATE XI.)

SUMMARY

THE molluscan fauna of the Wexford Gravels (Pleistocene) is listed from eight localities and the conclusion drawn that the southern and "Pliocene" (Crag) aspect has been overstressed. No obvious variation was noted in the molluscan fauna of the different localities. A. Bell's earlier work (1873-1919) is summarised and some of his records revised. The identity of the Wexford sinistral *Neptunea* is considered and the species named *N. informis* Harmer. A possible source of the Crag shells is suggested.

Other British Pleistocene deposits containing derived "Crag" shells are mentioned.

INTRODUCTION

In the south-east corner of Ireland glacial sands and gravels cover a wide area. Those known as the "Wexford gravels" (the "manure gravels" of older authors) are known to extend from Duffcarrig, about $1\frac{1}{4}$ miles north of Courtown Harbour, in the north of the county to near Tacumshin Lake* in the extreme south. On the east there are magnificent sections in the cliffs for several miles north and south of Blackwater, and westward the gravels extend for several miles.

The stratigraphical position of these gravels is between the Ballycreeen boulder-clay and the overlying Garryvoe-Brittis boulder-clay, and they are considered to be outwash materials from the Ballycreeen boulder-clay (Mitchell 1960). Mitchell (1962, p. 200) terms them the Wexford Outwash Gravel and states that these gravels occur as far west as Ballycotton Bay, Co. Cork.

* A. Farrington, private communication.

The Wexford Gravels have long been known to contain a suite of molluscan shells which include certain "Crag" species. A. Bell (1888; 1891; 1915; 1919), who recorded about a hundred species of mollusca, including eleven "Pliocene" species, maintained that the gravels were pre-glacial, but Cole and Hallissy (1914) showed that they are glacial and that the "Crag" shells upon which Bell laid such stress are derived. It seemed possible that a study of the molluscan fauna of the different localities in which the gravels could be examined might show informative variations in the species obtained. Accordingly in 1956, 1957, and 1960 material was collected from the following localities (beginning with the most northerly); Castle Ellis, Blackwater cliffs at Ballynaclash, Ballyvalloo and Ballinesker; Ballyhow Middle; Pollregan; Knockmore; Killurin (at the Deeps); Crosstown; Clonard Little. The results are here presented, together with an account of the previous records of mollusca from these gravels.

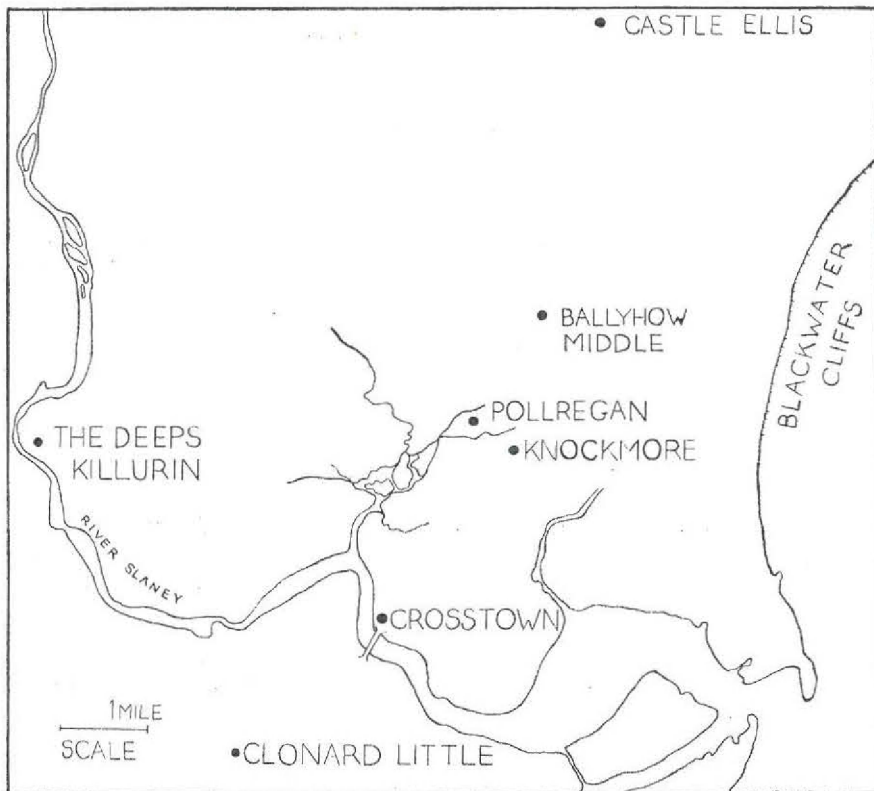


FIG. 1.—Localities where collection were made (1956, 1957, 1960).

It is beyond the scope of the present paper to discuss any of the geological problems afforded by the gravels, and therefore only the contained shells and their implications are considered.

Cole and Hallissy (1914) discussed work on the Wexford Gravels up to that date. Since then A. Bell (1915; 1919) has compared the Wexford shells with those of the gravels in the north of the Isle of Man where a somewhat similar fauna is found, and Harmer (1914–1925) described and figured very many Wexford shells. Hinch (1918) described the “Irish Sea Glacier” and referred to the great variety of erratics in the Wexford gravels as well as the Arctic and “Crag” shells.

Kennard (1944) has dealt taxonomically with several of the Wexford species and designated types in some cases.

LOCALITIES FROM WHICH SHELLS HAVE BEEN RECORDED

It is a great pity that in the British Association Reports upon the Wexford “manure gravels” (by R. Etheridge, H. Woodward and A. Bell, the last-named being the secretary) the species of mollusca recorded are not assigned to any definite locality. Bell, who was responsible for the fieldwork on the Wexford gravels, seldom stated from which locality he obtained any particular species. However, in the British Museum (Natural History) there are two MS. catalogues of “mollusca, etc. from the Manure Gravels of Ireland collected by A. Bell 1888 and presented by the British Association through R. Etheridge, 1888” which, by permission of the British Museum (Nat. Hist.) authorities I have been able to consult. In these catalogues precise localities are given, Pulregan (= Pollregan on the modern map 6" O.S. Wexford sheets 32, 33), Little Clonard. Three other localities given are not of the same age as the Wexford gravels and are, therefore, not considered further.

A large collection of Wexford shells presented by Bell to the National Museum, Dublin, in 1919, is accompanied by a MS. catalogue in Bell's distinctive handwriting “Wexford Gravels Blackwater” and by a careful comparison of this catalogue and the two in the British Museum (Nat. Hist.) with Bell's published lists and the records given by Harmer (1914–1925) it has been possible in nearly every case to assign the rarer species at least to their correct locality. Harmer has recorded many species from “Wexford” without any more definite locality, yet almost every “Wexford” species so listed is included in Bell's MS. catalogue of Blackwater shells, and in the Museum Register it is stated that some of the specimens are referred to in Harmer's *Pliocene Mollusca*. It seems probable that Harmer's records were largely based upon specimens from Blackwater whence Bell is known to have received so much material.

The Geological Survey of Ireland possesses some Wexford shells and by courtesy of the Director Mr. M. V. O'Brien I have examined them. All are labelled merely “Wexford” except one from Duffcarrig (a specimen marked Ballyteige is not of the same age).

Shells or shell-fragments have been recorded by Harkness (1869) from Artramon, Ballyhuskard, Ballyknockan, Ballyvaldon, Castle Ellis, Clonmore,

Killisk,† Killinkorley, Kilmackridge (= Kilmuckridge $4\frac{1}{2}$ miles north-east of Blackwater), Rathaspic, St. Margarets—all in Co. Wexford within the known area of the gravels under discussion.

The molluscan fauna of the Wexford gravels was first listed by Capt. H. James (1846), whose specimens were determined by Edward Forbes. Forbes also published James' list in his famous essay (1846). The next worker was Alfred Bell who collected vigorously from 1887–1890 and recorded (1888–1891; 1915) very many species, both of his own collecting and that of various helpers, notably the Rev. Father Codd of Blackwater. Bell (1888; 1891) also examined most of James' shells and in some cases revised them. Some of James' shells are now in the Geological Survey and Museum (London) and some in the National Museum, Dublin, according to Bell (1891).

Most of the specimens figured by Harmer in *Pliocene Mollusca* are in the Sedgwick Museum, Cambridge (Bell, in Harmer vol. 2, preface).

Concerning the species recorded by Bell and Harmer it must be remembered that Bell had a lifelong experience of such work and an almost uncanny ability to identify material too fragmentary for most workers to attempt to name. Temperamentally, however, both he and Harmer were "splitters" and some of their finer distinctions may not stand. Bell also sold shells so that there was a natural inclination to find as many species as possible. I have not attempted to check his determinations except in some cases where the records appeared to need confirmation. Notes on these records will be given later in this paper.

LIST OF SPECIES RECORDED

In the following lists the localities are dealt with in their order from north to south; under each locality the mollusca obtained by the writer are first listed, and then those species recorded by others and not refound.

The large quantity of shell-fragments obtained in relation to near-intact specimens is at first sight discouraging, but with practice, and beachworn recent material for comparison, much is identifiable.

As regards the vexed question of nomenclature, Winckworth's list (1932–3) has been followed with some emendations, and names throughout have been brought into conformity. I have tried to use names intelligible to those who are not taxonomic specialists and as far as possible to avoid subgeneric and sectional names as well as trinomials. For the fossil species I have consulted *British Cenozoic Fossils* (British Museum (Nat. Hist.)).

DUFFCARRICK (or Duffcarrig). About $1\frac{1}{4}$ miles north of Courtown Harbour. In the collection of the Geological Survey of Ireland there are valves of *Ostrea edulis* L. labelled as from this locality.

† ? Killincooly.

CASTLE ELLIS. Two miles west of Blackwater. Just south of Ballyknockan cross-roads, on the east side of the Wexford road, is a large overgrown gravel-pit. Shell-fragments were fairly common and the following species were represented :

- Buccinum undatum* L. Fragment.
Nucella lapillus (L.) var. *menapiae* Harmer. Two fragments.
Glycymeris glycymeris (L.) Three fragments.
Mytilus edulis L. Seven fragments.
Spisula sp. Two fragments. *Venus casina* L. One fragment.

Harkness (1869) notes that he collected *Neptunea antiqua* at Castle Ellis and that the shells were of "the ordinary kind" (i.e. presumably the dextral form. N.F.McM.).

GLENBRIAN. Four miles east of Enniscorthy. Huxley and Etheridge (1865, p. 375) record *Venus casina* L. from this locality.

BLACKWATER. High cliffs of clay, sand and gravel stretch along the Wexford coast in the Blackwater district and rise at Blackwater Head to 160 ft. The cliffs were examined from Blackwater Harbour south to the White Gap at Curraclloe (4 miles). Shell-fragments were frequent in both sands and gravels but complete shells were almost confined to the finer gravel. Ballynaclash, Ballyvalloo, and Ballineskar (at Bently Cottage) were the most productive localities.

The following species were obtained :

- Acteon tornatilis* (L.). One.
Buccinum undatum L. Several, a thin fragile form.
Nassarius incrassatus (Ström). Two and a fragment.
N. reticulatus (L.). One.
Natica cf. *pallida* Brod. et Sow. One.
Neptunea sp. Two sinistral apices.
Ocenebra erinacea (L.) One and a lip-fragment.
Sipho islandicus (Gm.). One.
S. latericeus (Möller). A basal whorl. Compared with recent material from Finmark (G.O. Sars Coll.) and agrees fairly well (*vide* C.P. Castell).
S. menapiae Harmer var. *hibernica* Harmer. One.
Trivia monacha (da Costa). One. I have used the specific name in the aggregate sense to include both *monacha* (da Costa) *sensu strictu* and *arctica* (Mont.) as the colourless fossil shells of the two species cannot be separated.
Trophonopsis clathratus (L.). Four, *det.* J. Knudsen.
T. truncatus (Ström). Numerous, the largest complete shell 10 mm. high. All confirmed by Knudsen.
Turritella communis Risso. Two.

- T. incrassata* J. Sow. Two fragments.
Arctica islandica (L.) Fragment.
Astarte montagui (Dillwyn). One small valve.
A. sulcata (da Costa). Several fragments.
Glycymeris glycymeris (L.). A hinge-fragment.
Mya truncata L. Hinge-fragment.
Mytilus edulis L. Three fragments.
Nuculana pernula (Müller). One valve.
Pecten maximus L. One small fragment.
Spisula elliptica (Brown). Several fragments.
Venus casina L. Fragment.

The large collection of Wexford material presented by Bell to the National Museum of Ireland, Dublin, in 1919, is stated to have been determined by Bell and Harmer, and the specimens are labelled in the handwriting of both authors. All the material is from Blackwater, and Bell's MS. catalogue yielded nearly one hundred species additional to my list from that locality. Thirty-two of the more interesting species were accordingly borrowed and critically examined. It was found that ten were wrongly named and nine were new only in name, being synonyms of better-known species already recorded. The catalogue also contained a number of synonyms which have had to be deleted from the list of supposed additions. The following list therefore represents a partial revision of Bell's and Harmer's work, because, as already mentioned, it seems probable that Harmer's records of Wexford species in *Pliocene Mollusca* were based upon Blackwater specimens.

Species recorded by Bell (MS. Blackwater catalogue) additional to my list. Asterisked species seen by N.F.McM.

- Aporrhais pes-pelecani* (L.).
Admete viridula (Fab.).
A. couthouyi (Jay). Usually now regarded as a variety of *A. viridula*.
 **Buccinum conoideum* Sars. One shell, 30 mm. high, agrees fairly well with Sars' figure (1878, t.34, f.7) but the species is now considered to be identical with *B. undatum* (Thorson 1941).
 **B. finmarkianum* (Verkr.) G.O. Sars. An imperfect shell which seems to be correctly named. Harmer records "2 or 3" from Wexford.
 **B. fragile* (Verkr.) G.O. Sars. So named in the catalogue, but marked on box "B. undatum fragile" and the five small shells are merely the small fragile form of *B. undatum* common in the gravels.
 **B. pulchellum* Sars? A small creamy-white shell 22 mm. high so labelled agrees fairly well with Sars' figure. The name appears unquestioned in the catalogue.
 **B. tenue* Gray. The catalogue entry of this species is based upon a rather slender *B. undatum* labelled "B. undatum tenue". It is certainly not *B. tenue* Gray.

- Capulus ungaricus* (L.).
Diodora apertura (Mont.).
Lacuna crassior (Mont.).
Littorina littorea (L.).
L. littoralis (L.).
Lora turricula (Mont.) and var. *rosea* Loven.
L. pyramidalis (Ström).
- **L. nobilis* (Möller). The following were also listed: **L. scalaris* (Möller), **L. ecarinata* Sars, **L. rugulata* Troschel, and **L. scalaroides* Sars, but all are now regarded as identical with *nobilis* (Thorson 1941).
- **L. exarata* (Möller). The shell so labelled in Harmer's hand is not this species but *nobilis*.
- L. rufa ulideana* Thompson. The largest of the three shells labelled by Harmer "*ecarinata* Sars" (i.e. *L. scalaris* Möll. var. *ecarinata* Sars. N.F.McM.) belongs to the present species.
- Melampus pyramidalis* (J. Sow.).
Mitra cornicula (L.).
Natica catena (da Costa).
N. nanum Möller.
N. fusca Blainville? (sub *N. sordida*?).
N. alderi Forbes?
Nassarius reticosus (J. Sow.).
- **N. labiosus* (J. de C. Sow.) One, checked by N.F.McM.
- **N. elegans* (J. de C. Sow.). One, checked by N.F.McM.
- N. nitida* Jeffreys. Usually regarded as a variety of *N. reticulata*.
- Neptunea antiqua* (L.).
- **N. pertenuis* Sykes *Proc. Malacological Soc. IX* 339-340 and text-fig. 1911. A shell so labelled is not separable from two shells named by Bell "*Sipho latericeus* of Sars". See notes under that species.
- Nucella lapillus* (L.).
- **Scala greenlandicum* (Perry). One, sub *S. similis*.
Sipho curtus (Jeffreys) and several slight varieties.
- **S. exiguus* Harmer. The shell labelled by Bell "*Sipho exiguus* Sabini EF" agrees perfectly with Harmer's description and figure. van Regteren Altena *et alia* (1956, p. 90) remark that *Colus exiguus* of v. R. Altena (1937) (? *nec* Harmer 1914) is a synonym of *Colus cordatus* (A. Bell 1871); the Blackwater shell is not identical with *cordatus*; it is smaller (only 32 mm. high as against the 45-50 mm. height of *cordatus*), and has less rounded whorls and a shallower suture.
- S. fenestratus* Turton? (sub *Neptunea fusiformis* Brod.?).
S. gracilis (da Costa), and vars. *convoluta* Jeff., *coulsoni* Jordan, and *elongatus* Harmer.
S. howsei (Marshall) (sub *S. propinquus*).
S. jeffreysianus (Fischer).

- *“*S. latericeus*”. In Bell’s catalogue the following are listed.
Sipho latericeus Mörch, *S. latericeus* Sars, and *S. latericeus* Möller.
S. latericeus Möller is represented by three small shells identical with a slightly larger specimen labelled “latericeus Uddevalla” (? possibly this represents the *latericeus* Mörch of the catalogue, otherwise unrepresented). The two shells labelled “latericeus of Sars” are not separable from the specimen named *Neptunea pertenuis* Sykes, and all differ from the *latericeus* Möller and the Uddevalla examples in the longer spire and narrower body-whorl of the first two species. Harmer (*Pliocene Mollusca* II, 189 and 374) has similarly separated the two groups.
- S. togatus* (Mörch) var. *crassus* Harmer.
- **Searlesia forbesi* (Strickland). One. Not this species but a much-worn “Trophon”, apparently *clathratus*.
- Trophonsis muricatus* (Mont.).
T. harmeri Harmer (= *T. truncatus* var. *harmeri* Harmer).
T. coddii Harmer (= *T. gunneri* Lovén var. *coddii* Harmer).
- **Turritella biplicata* (Bronn). Two imperfect specimens. The larger fragment with angulated base is correctly named, but the other appears to belong to another species; it has a rounded base and coarser sculpture. v. R. Altena *et alia* (1955) place *biplicata* doubtfully as a synonym of *triplicata* (Brocchi).
- **T. triplicata* (Brocchi). An imperfect shell and a basal fragment (2 whorls), both correctly named. Now usually regarded as a variety of *incrassata* J. Sow. (Beets 1946). v. R. Altena *et alia* (1955) use *triplicata* (Brocchi) in preference to *incrassata* J. Sow. A fragment labelled **Turritella asperula* Brongn. is also *triplicata*.
- Acila cobboldiae* (J. Sow.).
Anomia ephippium L.
Arca lactea L.
Astarte elliptica (Brown).
A. crebicostate Forbes.
- **A. richardsoni* Reeve? Now regarded as synonymous with *A. semisulcata* (Leach) = *A. borealis* of authors.
- **Cardita senilis* (Lam.) A small valve labelled “*C. rudista* Lam.” Bell (1870) states that “*C. rudista* Lam. = the long variety of *C. senilis*”.
- Cardium echinatum* L.
C. edule L.
C. crassum Gm.
C. tuberculatum L.
- **Chlamys islandica* (Müller). Two large auricles. One is correctly named, but the other belongs to *Pecten maximus*.
- C. distorta* (da Costa).
C. opercularis (L.).
C. varia (L.).

Donax vittatus (da Costa). The following species of *Donax* are also recorded by Bell; **D. venustus* Poli var. *intermedia* BDD, **D. semi-striata* Poli, and **D. trunculus* (L.)—a single imperfect valve in each case. All are *D. vittatus*.

Dosinia lupinus (L.).

Ensis ensis (L.).

E. siliqua (L.).

**Glycymeris pilosa* (L.). A small valve, 26 by 26 mm., so named by Bell is not var. *pilosa* (of *G. glycymeris* L.) as generally understood and does not agree with Mediterranean examples. Lamy (1912) considered *pilosa* to be hardly a variety. Bell's valve is thinner, flatter, and has a finer hinge-line than similarly-sized typical *glycymeris*; save for the orbicular outline it reminds one of Red Crag shells (i.e. *Glycymeris variabilis variabilis* J. Sow. 1824), and is probably an example of that variable species.

**G. violacescens* Lamarck. The material labelled by Bell "Pect. violascens see sculpture in B.D.D. pl. 36" comprises five fragments. Three are *G. glycymeris* but the other two exhibit a peculiar latticed sculpture apparently due to wear. Worn *G. glycymeris* show a somewhat similar sculpture though not so well marked; despite Bell's statement the figures of Bucquoy, Dautzenberg and Dollfus (1891) do not illustrate the peculiar sculpture on the two fragments. Compared with recent *violacescens* (unfortunately no worn specimens were available) Bell's two much-worn fragments could belong to that species, but they could equally well belong to worn *glycymeris*, and for the present it seems wiser to leave these enigmatic fragments under *glycymeris*.

Hiatella arctica (L.).

H. gallicana (Lam.) (sub *rugosa*).

Irus Irus (L.).

Limopsis anomala (Eichwald 1830). I have not seen this.

Lutraria lutraria (L.) and var. *angustior* Phil.

Macoma balthica (L.).

Mactra cinerea Mont.

Modiolus modiolus (L.).

Ostrea edulis L.

Panomya arctica (Lam.).

Paphia aurea (Gm.).

P. rhomboides (Pennant).

P. pullastra (Mont.).

**Petricola rupestris* Brocchi? A fragment so named is a scrap of *Donax vittatus*.

Solen marginatus Mont.

Spisula solida (L.) and var. *truncata*.

S. subtruncata (da Costa).

**Tellina balaustina* L. Four valves so labelled are the strong form (*rubra* da Costa) of *Macoma balthica*.

T. crassa Pennant ?

Venus fasciata (da Costa).

Zirfaea crispata (L.).

Harmer records the following additional species: *Volutomitra greenlandica* (Möller), *Galeodea rugosa* (L.) (sub *Cassidaria tyrrhena* Chem.), *Trophonopsis barvicensis* (Johnston), *T. fabricii* (Beck) Möller var. *bailyi* Harmer, and *Wexfordia dautzenbergi* Harmer.

Between Blackwater and Screen in a sandpit on the great terminal moraine Mr. A. W. Stelfox collected the following on 23.7.1937.

Sipho gracilis (da Costa) one, and ? *Neptunea* sp., a fragment. "The sand-pit is beside the road and at the highest point of the same between Blackwater and Screen, about 10-12 miles north of Wexford town" (Stelfox *in litt.*).

BALLYHOW MIDDLE. A large sand and gravel-pit by the roadside six miles south-west of Screen. The pit was opened in 1959 and I visited it on 29.3.1960. About 25 ft. of current-bedded sands and gravels were seen, dipping roughly from north to south. Shell-fragments were fairly common.

The following species were obtained:

Buccinum undatum L. Half a dozen.

Nassarius incrassatus (Ström). Four.

Natica clausa Brod. et Sow. One small shell.

Nucella lapillus (L.) (probably var. *menapiae* Harmer). One small bit.

Neptunea sp. A sinistral apical fragment.

Ocenebra erinacea (L.). Three small shells.

Trivia monacha (da Costa). The aggregate species.

Trophonopsis clathratus (L.). One verified by J. Knudsen.

T. truncatus (Ström). Numerous, all verified by Knudsen.

Turritella communis Risso. One.

Astarte sulcata (da Costa). A fragment. Indeterminable *Astarte* fragments frequent.

Cardium edule L. Three fragments.

Glycymeris glycymeris (L.). A hinge-fragment.

Modiolus modiolus (L.). One fragment.

Mytilus edulis L. Four fragments.

Spisula sp. (? *elliptica* Brown). Fragments.

Venus casina L. Fragment.

POLLREGAN. Bell collected from this locality which is half a mile east of Castlebridge. Mr. Albinus O'Rourke, who is now working a gravel-pit here, kindly gave me a collection of the larger shells which he had gathered from the gravel. *Neptunea contraria*, (L.) var. *informis* Harmer and *Nucella lapillus* (L.) var. *menapiae* Harmer were by far the most abundant species.

The following species were obtained (including Mr. O'Rourke's shells).

Buccinum undatum L. Fairly plentiful, all of a small thin form (max. height 30 mm.). Mr. Knudsen has determined them as the present species.

Littorina littorea L. One, coll. O'Rourke.

Lora turricula (Mont.). Three.

Mangelia laevis (Harmer 1920). A single imperfect shell agrees with Harmer's description and figure (*Pliocene Mollusca* II, p. 523 and pl. xlvii, f. 10). In its imperfect condition the Pollregan shell is 9 mm. high, the body-whorl being 6 mm. and the next whorl 3 mm., the remaining whorls being absent. Kennard (1944) has a note on this species.

Nassarius incrassatus (Ström). Seven.

N. reticulatus (L.). Five. One has a strongly-denticulated aperture and a varix on one whorl.

Neptunea antiqua (L.) var. *inversa* Harmer. One shell which lacks the expanded body-whorl and striae of *N. contraria* (L.) var. *informis* Harmer seems best placed under this variety. It agrees very well with Harmer's figure. The status of this variety of *N. antiqua* needs consideration. Bell used this varietal name for the Wexford sinistral *Neptunea* which Harmer called *N. contraria* var. *informis* see p.

N. contraria (L.) var. *informis* Harmer. Numerous. No dextral *Neptunea* was obtained.

Nucella lapillus (L.) var. *menapiae* Harmer. This thick clumsy form, first named by Bell but not formally described by him, was abundant.

Ocenebra erinacea (L.). Several, some very small.

Sipho gracilis (da Costa). One.

Sipho islandicus (Gm.). Two, verified by Knudsen, and a young shell.

S. menapiae Harmer. Nine.

S. menapiae Harmer var. *hibernica* Harmer. Eight. The two largest are 55 and 58 mm. high respectively.

S. tortuosa Reeve. One, verified by Knudsen.

Trivia monacha (da Costa). One. As before, the name is used in a wide sense to include both *monacha* (da Costa) s.s. and *arctica* (Mont.).

Trophonopsis clathratus (L.). Three, verified by Knudsen. Each had 14 ribs on the body-whorl.

T. clathratus (L.) var. *gunneri* Loven. Two, verified by Knudsen. Each had 10 ribs on the body-whorl.

T. truncatus (Ström). Not uncommon, and all verified by Knudsen. The number of ribs on the body-whorl varied from 16–20. Two specimens have 16 ribs each, rather more inflated body-whorls and rather longer canals directed sideways.

Turritella communis Risso. Six.

T. incrassata J. Sow. ? A doubtful fragment.

Astarte elliptica (Brown). Eight valves and a few fragments.

A. montagui (Dillwyn). One valve.

A. semisulcata (Leach). Fragments.

Arctica islandica (L.). A valve and fragments.

Cardita senilis (Lam.). One valve.

Cardium crassum Gm. One valve.

C. edule L. One valve and fragments.

C. echinatum L. One fragment.

Glycymeris glycymeris (L.) Three valves of typical *G. glycymeris*, all orbicular. Measurements; height (i.e. umbones to lower margin of valve) 45 mm., 28 mm., and 27 mm. Length from anterior end of valve to posterior) 44 mm., 27 mm., and 28 mm.

Macoma balthica (L.). Four valves.

Modiolus modiolus (L.). One fragment.

Mytilus edulis L. Half a dozen fragments.

Paphia pullastra (Mont.) ? Two fragments.

P. rhomboides (Pennant). One fragment.

Spisula elliptica (Brown). Fragments.

Venus casina L. Fragments.

V. fasciata (da Costa). One fragment.

Bell (MS. catalogues) has already recorded from Pollregan most of the species found by Mr. O'Rourke and myself, and in addition the following species which I did not obtain.

Lora rufa (Mont.). One.

Metzgeria alba (Jeff.). Two.

Nassarius pygmaeus (Lam.). One.

Natica groenlandica (Möller). Two.

Neptunea antiqua (L.). Four fragments.

Trophonopsis fabricii (Möller) (sub *Trophon craticulatus* Fab.) Two.

T. muricatus (Mont.). One.

Astarte sulcata (da Costa). One valve.

Hiatella arctica (L.).

KNOCKMORE. A sand-pit in Knockmore townland, and about $\frac{1}{2}$ mile south-east of Castlebridge. Shell-fragments rare. The following were obtained :

Neptunea contraria (L.) var. *informis* Harmer. One 65 mm. high, lacking the apical whorls. An unusually large example.

Sipho islandicus (Gm.) A large fragment.

CROSSLAND. On the left bank of the Slaney, a mile NNW. of Wexford town. Hallissy (1912) described this section (he did not name it but referred to it as "near Wexford town, along the northern shore of the Slaney estuary, a little to the N.W. of the new wooden bridge . . .") as showing the marl resting on the rock-floor with several feet of shelly gravel overlying it the latter capped with 6 ft. of an Upper Boulder Clay. In July 1956 the section seen was as follows :

Clay with many stones	.....	.....	.....	.....	12"
Sand with much coal	.....	.....	.....	.....	18"
Chocolate clay, no stones noted	.....	.....	.....	.....	15"
Sand and gravel alternately, with shell and coal fragments					5 ft.

Base not seen.

But in Sept. 1960 only the shelly gravel and the overlying boulder-clay were seen (Mitchell 1962).

In 1956 the following species were obtained, although shell-fragments were rare :

Aporrhais pes-pelecani (L.). One fragment.

Arctica islandica (L.). One fragment.

Astarte sp. Several fragments.

Cardium edule L. One fragment.

CLONARD LITTLE (The "Forth Mountain" of older authors, *vide* Bell 1889, p. 134). A gravel-pit about two miles WSW of Wexford town. In July 1956 a pit was being worked and although shell-fragments were rare the following were obtained :

Astarte elliptica (Brown). Several fragments.

Barnea candida (L.). A fragment.

Cardium edule L. Fragment.

Chlamys islandica (Müller). One small fragment of an auricle with the characteristic salmon-pink colouring.

Dosinia exoleta (L.). A fragment.

Mytilus edulis L. Fragments.

Spisula solida (L.)? a fragment.

Bell obtained many species from this locality and in his MS. catalogues the following species additional to the above list are recorded :

<i>Buccinum undatum</i> L.	<i>Arctica islandica</i> (L.)
<i>Lora rufa</i> (Mont.).	<i>Astarte montagui</i> (Dillwyn).
<i>L. turricula</i> (Mont.).	<i>A. semisulcata</i> (Leach).
<i>Nassarius incrassatus</i> (Ström).	<i>Cardium echinatum</i> L.
<i>N. reticulatus</i> (L.).	<i>C. tuberculatum</i> L.
<i>Neptunea antiqua</i> (L.).	<i>Chlamys distorta</i> (da Costa).
<i>Nucella incrassata</i> (J. Sow).	<i>Macoma balthica</i> (L.).
<i>N. lapillus</i> (L.).	<i>Modiolus modiolus</i> (L.).
<i>Sipho gracilis</i> (da Costa).	<i>Mya arenaria</i> L.
<i>S. howsei</i> (Marshall).	<i>M. truncata</i> L.
<i>Ocenebra erinacea</i> (L.).	<i>Ostrea edulis</i> L.
<i>Trophonopsis clathratus</i> (L.).	<i>Paphia decussata</i> (L.).
<i>T. muricatus</i> (Mont.).	<i>Pecten maximus</i> L.
<i>Turritella communis</i> Risso.	<i>Solen marginatus</i> Mont.
<i>T. incrassata</i> J. Sow.	<i>Spisula subtruncata</i> (da Costa).
	<i>Venus casina</i> L.
	<i>V. verrucosa</i> L.

RATHASPICK. Three miles south-west of Wexford town. Bell collected here and described the locality as "Mr. Moody's grounds"; he also said that it was the most southerly point to which he had traced the gravels. The following species have been recorded :

- Nassarius incrassatus* (Ström). Collected by Capt. James (Huxley and Etheridge 1865, p. 375).
- N. woodwardi* (Harmer 1914).
- Trophonopsis bailyi* (Harmer 1918). Collected by Capt. James (Huxley and Etheridge 1865 p. 375) (as *Trophon fabricii*). This shell is the Holotype of *Trophon fabricii* Möller var. *bailyi* Harmer 1914, raised to specific rank by Harmer (1918), and is listed by Kennard (1944). Harmer wrongly ascribed the locality to Co. Wicklow instead of Co. Wexford.

***COTT'S CROSS-ROADS.** A gravel kame in the low boulder-clay plain about 2 miles north of Tacumshin Lake yielded shell-fragments and the following were recognized :

- Neptunea* sp. or *Sipho* sp. One columella.
- Mya truncata* L. One fragment.

The following three localities all in Co. Wexford, were examined but no shell-fragments were found.

*Dr. Farrington, private communication.

(a) KILLURIN (at the Deeps). On the L. bank of the Slaney about a mile south-east of Killurin Railway Station, Hallissy (1912) recorded here the usual sequence of marl overlaid by shelly gravel and the latter capped with boulder-clay. In March 1960 several hours' search of these large gravel-pits produced neither shell-fragments nor coal. In one place 16–20 ft. of sand and gravel overlaid 3 ft. of chocolate clay with 3 ft. of sandy gravel beneath. Another section showed 3–4 ft. of sand and gravel resting on chocolate clay containing a few stones.

(b) North shore of the Slaney estuary a few hundred feet downriver from the new bridge (that opened Sept. 1959) the following section was noted March 1960 :

Surface soil	.....	.....	.....	.....	8"
Rather angular stones up to 2" diam. (white quartz, flint, a good deal of coal)	.....	.....	.....	.....	2"–3"
Sand	.....	.....	.....	.....	3 ft.
Earthy peat	.....	.....	.....	.....	5"
Fine gravel and sand (not stratified)	.....	.....	.....	.....	6 ft.
(not penetrated)					

(c) BEGERIN ISLAND, Wexford Harbour. This was an island until the slobland was reclaimed about 1848. In Sept. 1957 a shallow excavation at the north end of the island showed :

Surface soil	.....	.....	.....	.....	3"
Gravel and earthy sand	.....	.....	.....	.....	2 ft.
(not penetrated)					

About the middle of the gravel was a thin impermanent layer of coal fragments.

BALLINABRANAGH, Co. Carlow. The enigmatic shells of Crag facies recorded by Cole (1912, p. 11) from Ballinabranagh, 5 miles south of Carlow (further examples were later obtained by Hallissy, private communication of 7.9.1937) may be mentioned here. Only *Glycymeris* and *Fusus* were obtained, but their iron staining and general appearance suggested a Crag origin. No section was seen, the shells being scattered on a ploughed field.

KILBRIDE, Co. Wicklow. The famous *Cypraea* from Kilbride (coll. James), referred to *C. spurca* Linn. by Harmer, has been dismissed as a modern intruder by Kennard (1944). Bell (1889) stated that Kilbride was given as a locality for some of James' rarer fossils by Huxley and Etheridge (1865) but only the *Cypraea* (above) is listed by them from that locality.

(Note by A. Farrington:—

There are four Kilbrides in Co. Wicklow

1. O.S. 6" Sheets 1, 5. Fragments of marine shells have been found in gravels two miles north-west of Kilbride.
2. O.S. 6" Sheets 4, 7, 8. In the valley of the Dargle. Dr. R. Ll. Praeger collected shells here in 1894.
3. O.S. 6" Sheets 31. Three miles west of Ardmore Point, probably within the area of the shelly drifts.
4. O.S. 6" Sheet 40. Half a mile north of Arklow town and half a mile from the coast well within the area of shelly drifts.

The sites 2 and 4 are the more likely for James' record.)

LIST OF SPECIES RECORDED FROM "WEXFORD" ONLY, AND NOT OTHERWISE RECORDED

- Buccinum meridionale* Verk. MS. var. *elongato-undosa* Sparre Schneider MS. Recorded by Bell (1915). Both specific and varietal names should be attributed to Harmer 1914.
- Calliostoma zizyphinum* (L.). Recorded by James (1846).
- Cantharidus exasperatus* (Pennant). James (1846).
- Fusinus crispus* (Brocchi) ? Recorded (as *Fusinus crispus* ?) by Forbes (1846) and apparently considered by Bell to be *F. rostratus* Deshayes, though he does not state whether he ever saw Forbes' shell. Beets (1946, p. 88) remarks "the real *Fusinus crispus* whether regarded as a species or as a variety of *F. rostratus* . . .".
- Gibbula magus* (L.). Shells in coll. Geol. Survey Ireland.
- Lacuna parva* (da Costa) ? James (1846) sub *L. montagui* ?
- L. vincta* (Mont.). Bell (1891) sub *L. divaricata*.
- Littorina saxatilis* (Olivi). James (1846) sub *L. rudis*.
- Lora harpa* (Dall). Recorded by Harmer sub *Bela borcalis* Reeve. See Beets (1946).
- L. harpularia* (Couthouy). Recorded by Harmer. Grant and Gale (1931, p. 524) state that the true *harpularia* of Couthouy is not "*Bela harpularia* Couthouy of Sars *Moll. Regt. Arct. Norv.*" so the identity of Harmer's specimens needs investigation.
- L. trevelliiana* (Turton). Also recorded by Harmer.
- Mangelia coarctata* (Forbes). "Wexford" (Harmer). Two shells labelled *M. costata* in coll. Geol. Survey Ireland are not this species, but agree with Harmer's figures of *Lora pyramidalis* (Ström) var. *laeviuscula* Harmer (*Pliocene Mollusca* II, 297-8, pl. xxxii, figs. 3-4.)
- M. tenuistriata* (A. Bell 1871). One (Harmer).
- Nassarius gigantula* (Bellardi). One (Harmer). Considered by Beets (1946) to be merely a large form of *N. labiosus*.
- Neptunea despecta* (L.) var. *tornata* Gould. One (Harmer).
- Patella vulgata* L. James (1846). A shell in coll. Geol. Survey Ireland.

- Patelloida virginea* (Müller). Recorded by Harmer.
Sipho torrus (Locard). One, det. Dautzenberg (Harmer).
Trichotropis borealis Brod. et Sow. Recorded by James (1846) but queried by Bell (1891).
Dentalium entalis L. Bell (1889). Specimens in coll. Geol. Survey Ireland.
Aloidis gibba (Olivi). James (1846) sub *Corbula nucleus*.
Callista chione (L.). Bell (1891).
Chlamys tigerina (Müller). Bell (1891).
Nucula proxima Gould? Forbes (1846) but specimen not seen by Bell (1891).
N. tenuis (Mont.). Forbes (1846).
Pinna fragilis Pennant. Bell (1891).
Venus striatula (da Costa). Valves in coll. Geol. Survey Ireland.
Yoldia hyperborea Torell. James (1846). Forbes (1846) listed the specimen as *Leda* (*Yoldia*) *oblongoides* Wood, but Bell (1891) who examined it stated that it was merely a hinge-fragment of *Y. hyperborea*.

ERRONEOUS RECORDS (FROM "WEXFORD" ONLY)

(Note: see also under list of Blackwater species)

- Nassarius semistriatus* (Brocchi). Recorded by James (1846) but not seen by Bell (1891). Harmer (I, p. 329, footnote) suggests that *N. labiosus* (J. Sow.) was the species really found by James.
Philbertia linearis (Mont.). Jeffreys (1867, IV, p. 369) records this species (as *Defrancia linearis*) "Fossil in Ireland" (J. Smith) but neither James nor Harmer list it from Wexford. Forbes (1846, p. 426) refers to "a small species nearly allied to *Pleurotoma linearis*" and this is probably the source of Jeffreys' record.
Pyrene sulculata (S. V. Wood) was recorded (as *Columbella*) from Wexford instead of from the Isle of Man by Bell (1915). See Harmer (Vol. I, p. 308) where the species is correctly recorded.
Scala trevelyana (Johnston). Recorded by James, according to Bell (1889), but the species is not listed by James, Forbes or Harmer.
 "Leda pusio" Recorded by James (1846), but not seen by Bell and queried by him (1891).
Thracia convexa (W. Wood). Jeffreys (1865, III, p. 40) records this species from Wexford on the authority of James, but it does not occur in either James' or Forbes' lists.

NOTES ON SOME OF THE MOLLUSCA OF THE WEXFORD GRAVELS

(a) The sinistral *Neptunea* (Plate XI.)

As the sinistral *Neptunea* is a comparatively abundant shell in the Wexford gravels its identity is important. It is quite distinct from the Crag *N. contraria* (L.) to which it has been referred.

Neither Forbes (1846) nor Jeffreys (1867) differentiated between the sinistral and dextral *Neptunea*, regarding the sinistral form as a "reversed" freak of the normally dextral *N. antiqua* (L.). S. V. Wood (1848) also relegated the abundant Red Crag sinistral shell to the status of a variety of *antiqua*. Later, the Red Crag sinistral shell was generally called *N. contraria* (L.) and regarded as conspecific with the recent *N. contraria* of Vigo Bay. Both Crag and recent examples of *N. contraria* are distinct from the *Neptunea* of the Wexford gravels, which is a thick heavy shell with an inflated body-whorl and a short spire. The proportions of the two forms are equally distinct; in the Crag species the body-whorl occupies about 57% of the total height, whereas in the Wexford shells the body-whorl accounts for 67% of the total height.

When the Wexford sinistral *Neptunea* was first found it was referred by Forbes (1846) to "*Fusus antiquus* Müller (Reversed variety) *Fusus contrarius*". A. Bell (1889) separated the two forms as *Fusus antiquus* and *F. contrarius* apparently assuming the latter to be the Crag shell although R. G. Bell (1887) had already drawn attention to "the small reversed form from the Wexford gravels" as being different from any other known to him. Later, A. Bell (1915, p. 169) referred to the Wexford shells as being "a strong form, now lost".

Harmer described the Wexford shells as a new variety of *N. contraria*, *informis* (*Pliocene Mollusca* I, p. 60, pl. xvi, f. 8. 1914), mentioning later (pp. 367-8) that he had taken one or two of this variety in the Crag but that it was abundant in Wexford and also occurred in the Isle of Man. He considered that it was more nearly related to the Arctic *Neptunea* (*Pyrulofusus*) *deformis* (Reeve 1847) than to the Crag *N. contraria* (L.).

At this point it seemed essential to make a direct comparison between the Wexford shell and *N. deformis* and the British Museum (Natural History) authorities kindly lent me a Spitzbergen specimen of the latter species. It was immediately obvious that the two species were not identical, though closely allied. The differences may be summarised thus:

<i>N. deformis</i> (Reeve)	Wexford shell
Larger (height 82 mm. of shell examined. Macginitie (1959) records a shell 142 mm. high by 83 mm. diam.	Smaller (average height of 3 of the larger Pollregan shells only 48 mm.). Largest shell obtained was 65 mm. high — from Knockmore.
Shell, thin but strong.	Shell thick and heavy.
Spiral striae on body-whorl rather irregular, about 2 mm. apart.	Spiral striae close and regular not more than 1 mm. apart.

The proportions of aperture and body-whorl to total height are almost identical in the two species.

Too much reliance should not be placed on the spiral striae as a distinguishing characteristic for Macginitie (1959) in her account of Alaskan material of *N. deformis* remarks that there is a good deal of variation in this feature. Size, and texture of the shell, are the best criteria for separating the two species.

The Wexford sinistral shell having been shown to be distinct from both *N. deformis* Reeve and *N. contraria* (L.) is now nameless and I therefore propose to raise Harmer's varietal name *informis* to specific status; consequently the Wexford shell becomes *Neptunea informis* Harmer.

Harmer figured a sinistral recent *N. antiqua* (L.) as var. *inversa* nov. and separated a sinistral *Neptunea* from Wexford (pl. xxxvi f. 27) under this name. Bell, however, called the ordinary Wexford *Neptunea* *N. inversa* or "var. *inversa*" instead of *informis*, and I have seen several lots of material labelled *N. inversa* by him which are undoubtedly *N. informis*.

Beets (1946, p. 76) records one specimen of *N. contraria* var. *informis* Harmer, and quotes v. R. Altena as having also recorded the variety, from Holland.

(b) The species of "Trophon"

Harmer stated "The variety and abundance of these small Trophons in the Wexford beds is remarkable . . . Taken as a whole they seem to form a special group different from that of any recognized horizon of our Pliocene or Pleistocene deposits, or of the existing seas of Great Britain or Scandinavia." I found specimens to be fairly numerous but only two species were represented in my gatherings, *Trophonopsis clathratus* (L.) and *T. truncatus* (Ström). Macginitie (1959) has remarked on the variation within these two species and this is true of the Wexford material, I am grateful to Mr. J. Knudsen for checking all the "Trophons" I obtained.

T. truncatus was the more frequent species with from 16–20 ribs on the body-whorl. Two shells from Pollregan had each an inflated body-whorl with 16 ribs.

In *T. clathratus* the number of ribs on the body-whorl ranged from 13–15. Two examples of the var. *gunneri* Lovén had each ten ribs. Harmer regarded *gunneri* as a species and described a new variety *gunneri* var. *coddii* (*Pliocene Mollusca* I, 353, pl. 38, fig. 21, 1916) from a single Wexford shell.

OTHER RECORDS OF "CRAG" SHELLS AS GLACIAL ERRATICS

Much was made by Bell of the Crag shells in the Wexford gravels but such shells also occur as derived fossils in other Pleistocene deposits in Great Britain. The Pleistocene gravels of the Point of Ayre in the north of the Isle of Man (Lamplugh 1903) yield a suite of shells comparable with that of the Wexford gravels, and Bell (1915) linked them together because they similarly contained such species as *Nassarius reticosus*, *Searlesia* spp., and *Neptunea contraria*. According to Harmer *N. contraria* var. *informis* occurs in the Manx deposits.

In the following records "*Neptunea contraria*" is used in a broad sense as including both the Crag *N. contraria* (L.) and the Wexford *N. informis* Harmer because the material is almost always too fragmentary to allow of specific determination.

In Ireland Sollas and Praeger (1895) found *N. contraria* as well as other Crag Mollusca and the Crag foramifer *Nodosaria orthopleura* Rss. in boulder-clay at Kill-o'-the-Grange, Co. Dublin. An undescribed *Nassarius* from this locality was figured by Kendall (1894, fig. 21) but Dr. Praeger wrote to me in 1948 "The Pliocene shells from Kill-o'-the-Grange and others that were believed Pliocene from Killiney section were sent to Percy Kendall and none—or very few—were ever returned". Their ultimate fate has not been ascertained. For an account of the Killiney section see Sollas (1894).

Neptunea contraria has been recorded from N. E. Ireland (Belfast water-works boulder-clay 2 specimens, Bell 1873) and there is a specimen labelled "*Fusus gracilis* Post-Pliocene (Boulder-clay) Antrim Road. (i.e. Belfast water-works. N.F.McM.) purchd. G. Donaldson 1913" in the British Museum (Nat. Hist.). Mr. C. P. Castell has kindly examined this shell and tells me that it is not var. *informis* but appears to be identical with shells determined by Bell as *N. antiqua* var. *inversa*. Mr. A. W. Stelfox, who knew Donaldson personally tells me that his localities are not always reliable. However, as the record is substantiated by a specimen, reference must be made to it.

At Killincarrig, near Delgany, Co. Wicklow, a gravel-pit yielded such characteristic Crag species as *Scaphella lamberti* (J. Sow.), *Natica multipunctata* S. V. Wood, *Nucella tetragona* (J. Sow.), *Ocenebra kendalli* Harmer *O. tortuosa* (J. Sow.), *Nassarius reticosus* (J. Sow.) and *Cardita senilis* (Lam.), together with four species of *Searlesia* (McMillan 1938). The most abundant species were *Nassarius reticosus*, *Searlesia forbesi* Strickland and *S. nordmanni* Harmer; no sinistral *Neptunea* was obtained. Mitchell (1960, p. 314) equates the Killincarrig shells with those of St. Erth.

Across the Irish Sea *Neptunea contraria* is of frequent occurrence all through South Lancashire and Cheshire (Kendall in Slater 1929); some localities are Worden, near Leyland, Lancs. (Darbishire 1874; Farrington 1879); Liverpool area (Morton 1891) and Gloppa, near Oswestry (Nicholson 1892). Farther south, in the Cardiganshire gravels described by Williams (1927, pp. 218-220) and which are considered by Mitchell (1960 p. 319) to be of the same age as the Wexford gravels, no Crag shells have been found.

Two records of *N. contraria* from the west of Scotland are discussed later in this paper.

Although not directly relevant to the problem of the Wexford Crag shells it may be mentioned that elsewhere in Scotland Crag shells (including *N. contraria*) occur in Aberdeenshire gravels (Jameson 1865; 1882), and at Leavad in Caithness a huge erratic of Cretaceous sandstone covers a greenish clay containing Foraminifera for which a Crag age has been suggested (Crampton and Carruthers, 1914).

GENERAL COMMENTS

As far as is at present known the molluscan fauna of the Wexford gravels comprises about 133 species, composed of my gatherings and Bell's records (this total may have to be reduced when more of Bell's records have been checked) as well as the older records of James and Forbes. It is known that the quantity of Blackwater material handled by Bell was large and therefore my failure to re-find many of his recorded species is not surprising.

The molluscan shells found in the Wexford gravels are derived, just as the included erratics are, and therefore it is not possible to draw from them any conclusions as to their ecological significance except in the broadest sense. The most frequent shells in the gravels are *Trophonopsis* ("Trophon") spp., followed by the characteristic Wexford *Neptunea informis* and *Nucella lapillus* var. *menapiae*. Of bivalves probably *Astarte* spp., are the most abundant, and next *Glycymeris*.

Bell's 1915 list of eleven Pliocene, five southern, and eighteen northern species looks impressive but when scrutinized in detail is less so. Included in it without comment are the species collected by James and identified by Forbes even though in some cases Forbes set a question mark against the name. It is of course possible that further examples were taken by Bell and that his 1915 list refers to these as well as to James' fossils but if this is the case it is nowhere stated.

The "Pliocene" shells upon which Bell laid such stress are mostly represented by relatively few specimens or even single shells. Of the eleven supposed "Pliocene" species listed (1915) only five are really Crag species (*Melampus pyramidalis* J. Sow., *Nassarius reticosus* (J. Sow.), *N. woodwardi* (Harmer), *Turritella incrassata* J. Sow., and *Acila cobboldiae* (J. Sow.). *Pyrene sulculata* (S. V. Wood) was recorded (as *Columbella sulculata*) in error — see p. 281 *antea*, and "*Raphitoma laevis* sp. nov." and "*Trophon bailyi* A. Bell" are both founded on unique Wexford specimens. The remaining three species of Bell's list (*Neptunea contraria* (L.) var. *informis* Harmer, *Sipho menapiae* Harmer, and *S. hibernica* Harmer (described as "sp. nov." but usually regarded as a variety of *S. menapiae*), all fairly frequent, are characteristic Wexford species, and none or very few specimens have been obtained elsewhere.

Of Bell's five "southern" species the *Cypraea* has been dismissed as a modern intruder (Kennard 1944) and *Fusus* (now *Fusinus*) *rostratus* Deshayes is based upon Forbes' record of "*Fusus crispus*?" (see p. 280 *antea*). Neither "*Leda pusio* Philippi" nor *Nassarius semistriatus* (Brocchi) can be considered satisfactory records (see p. 281 *antea*). *Glycymeris pilosa* (L.) is also listed as a southern species but is not now regarded as separable from *G. glycymeris* (Lamy 1912). The following additional southern species are listed by Bell in his MS. catalogue of Blackwater fossils *Donax trunculus*, *D. semistriata*, *D. venustus* var. *intermedia*, *Tellina balaustina* and *Glycymeris violascens* but none is acceptable. For notes on these species see the Blackwater section of this paper (pp. 273-4 *antea*).

Eighteen species are listed by Bell (1915) as northern forms occurring in the Wexford gravels and notes on some of these will be found in the Blackwater section.

Considered as a whole the mollusca of the Wexford gravels have a strongly northern aspect and such characteristic northern genera as *Sipho*, *Neptunea*, *Lora*, *Trophonopsis* and *Astarte* are well represented. The real Crag species form only a minute proportion of the shells obtained and the characteristic species of the gravels are the sinistral *Neptunea contraria* (L.) var. *informis* Harmer (raised to specific status in this paper), *Sipho menapiac* Harmer and its variety *hibernica* Harmer, and *Nucella lapillus* (L.) var. *menapiac* Harmer.

The source of the Crag and similar shells is still unknown. As a corresponding assemblage is found in the Manx gravels at the Point of Ayre the origin may lie farther north. Herdman and Lomas (1898) writing of bottom-deposits of the Irish Sea, stated that erratics were plentiful and that shells glacially striated were found as well as many shells in a sub-fossil condition, but that there was no evidence of any Tertiary deposits as hoped for by Clement Reid.

The Turbot Bank, which lies across the mouth of Belfast Lough in 23-30 fm., yielded nearly 200 species of mollusca, many of the shells in a sub-fossil condition and some of northern and Arctic species not now living in British waters (Bell 1891), but no Crag shells nor any of the characteristic Wexford species were obtained.

A possible clue to the source of the Crag shells in the Wexford gravels is the occurrence of *Neptunea contraria* (one perfect shell) in a shelly clay at Cleongart Glen, Kintyre (D. Bell *et alia* 1897) associated with northern shells including such species as "*Leda pernula*", *Chlamys islandica*, and *Natica groenlandica*. The shelly clay, overlain by boulder-clay, is found in three glens opening westward (Tangy Glen, Drumore Glen and Cleongart Glen) and a pre-glacial age has been suggested (Kendall *in* Slater 1929). Charlesworth (1963, pp. 296-71), referring to these deposits, stresses that they are not shelly drifts but shelly clays like those of Clava, Nairn, and continues "Far from indicating the presence of an ice-sheet at that time they prove that the ice was not then in the neighbourhood; they belong to a different period." The Arctic and Crag shells of the Wexford gravels may be derived from similar deposits somewhere in the Clyde area; the presence of *Chlamys islandica* (at Blackwater and Clonard Little) also hints at this. *C. islandica* has been obtained from gravels at Whittle (about 3 miles from Worden, Lancs.) (A. C. Nicholson MS.).

Harmer has recorded *N. contraria* from Arran where similar shelly clays occur, but the species is not included in the list of shells given in the Geological Survey Memoir (Tyrrell 1928, p. 263).

Grateful acknowledgments are due to the following for help in various ways; Mr. C. P. Castell, Dr. A. Farrington, Dr. J. S. Jackson, Dr. J. Knudsen (Universitetets Zoologiske Museum, Copenhagen) and Mr. A. W. Stelfox, A.L.S.; to Mr. M. V. O'Brien, Director of the Geological Survey of Ireland, for the loan of their Wexford gravel fossils; to the British Museum (Natural

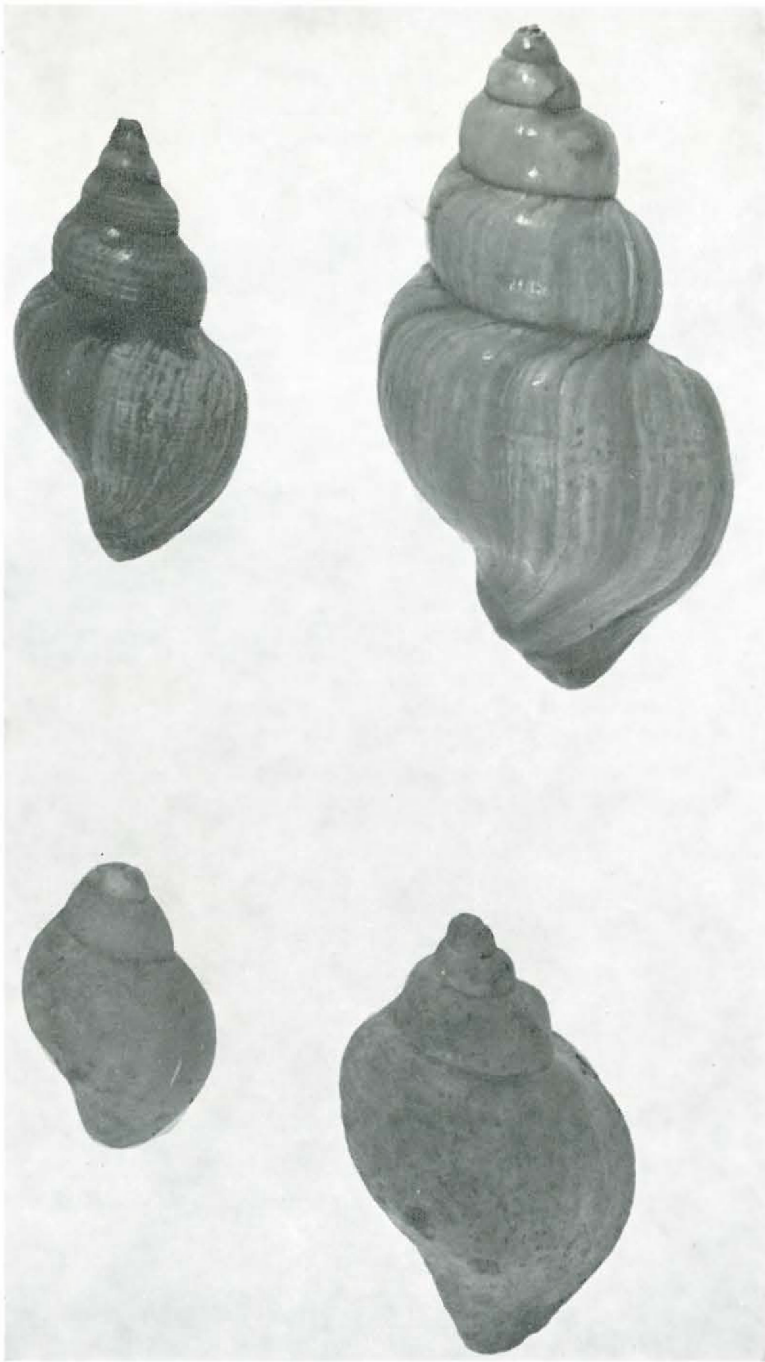
History) authorities for lending a specimen of *Neptunea (Pyrulofusus) deformis* (Reeve) and for permission to figure it; to refer to Donaldson's Belfast specimen of *N. contraria*, and to make use of Bell's two MS. catalogues; to the National Museum of Ireland, Dublin, for permission to use Bell's MS. catalogue of the Blackwater fossils, and for the loan of some of the shells. To my friend Mrs. Bridget Finlow for the accompanying map. And to the Royal Irish Academy for financial help with field-work.

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Neptunea spp.

- (top, L.). Red Crag *N. contraria* (L.). Woodbridge, Suffolk.
(top, R.). Recent *N. contraria* (L.). Vigo Bay, Spain.
(bottom, L.). Pleistocene *N. informis* Harmer. Wexford, Ireland.
(bottom, R.). Recent *N. deformis* (Reeve). Spitzbergen.
(B.M. Reg. No. 1911. 10.26.9832).