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RECORDS.

1954/25

FOSSILIFEROUS ROCKS FROM THE NULLARBOR PLAINS.

by

I. Crespin.

CANBERRA. A.C.T.

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Introduction.

In 1944, while Mr. H. B. Owen, geologist of the Bureau of Mineral Resources, was travelling by road from Port Lincoln, South Australia, to Norseman, Western Australia, he collected specimens of the Tertiary rocks for micropalaeontological examination. A detailed report on these samples has never been put on record, but, as the area is now being investigated for the possibility of oil accumulation, the samples have been examined and this report prepared. Some interesting observations made by Mr. Owen during the trip are incorporated here.

From Port Lincoln, the road across the Nullarbor Plains follows the coast closely as far as Eucla on the border between Western Australia and South Australia. From there it follows a westerly course but the coast trends south of west. The easternmost exposure of Tertiary rocks was observed near Colona Homestead in South Australia and the westernmost between Balladonia and Norseman in Western Australia, a distance westward from Colona of 550 miles. Sand and travertine cover the greater part of the surface over the intervening distance and opportunities to collect specimens from the Tertiary limestones were few. The accompanying map (Plate 1) shows the localities from which specimens were taken. Some were derived from spoil dumps of wells or other excavations and others from natural outcrop or road cuttings. Included also in this report is a sample collected by M. H. Johnstone from Madura Pass.

The most important results of the micropalaeontological examination of these limestones are:

1. The discovery of extensive deposits of upper Eocene age both in outcrop and in subsurface sections.

2. The similarity of the upper Eocene to lower Miocene stratigraphical sequence in the coastal area of the Nullarbor Plains with that found in portion of the Carnarvon Basin, Western Australia, in the Adelaide Basin, South Australia, in north-western Victoria, and in the Torquay area, central southern Victoria.

Descriptions of localities and fossiliferous content of the Limestones.

The sample numbers are those shown in Plate I.

A. Fowler's Bay Yalata Section.

Sample 1 cam from a ridge immediately north of the old Yalata Homestead. The bed consists of a shelly travertinous limestone about 15 feet thick.

The following foraminifera were recognised:

Marginopora vertebralis
Peneroplis pertusus (common)
Sprites marginalis
Spiroloculina sp.

The age of this rock is most probably Pleistocene.

B. Colona.

The first Tertiary limestones were collected at two localities near the Colona Homestead.

Sample 2 came from a spoil dump of a well 1 mile south-east of Colona Homestead. The well, which was dry, was about 140 feet deep. Two rock types were present in the sample bag.

1. Moderately friable calcareous sandstone with poorly preserved foraminifera.

   Calcarina verriculata
   Operculina victoriensis
   Sigmomorphina subregularis

   The age of this rock is lower Miocene (f_1-f_2 stage)

2. Hard bryozoal limestone with small foraminifera.

   Ammocabulites sp.
   cf. Guembelina
   Guttulina sp.
   Nodosaria sp.
   Planorbulina sp.
   Pseudoglandulina sp.

   The age of this rock is most probably upper Eocene.

Sample 3 was collected from a dump of a well about 9 miles north-west from Colona Homestead. This well was also dry and was about 250 feet deep. The rock was a moderately friable bryozoal limestone with numerous fairly well preserved foraminifera, siliceous sponge spicules, and ostracoda.

Foraminifera:

Angulogerina cf. cooperensis
Angulogerina sp. 1
Angulogerina spp.
Angulogerina subangularis
Anomalina perthensis
Anomalina subnonionoides
Anomalina westraliensis
Bolivina aff. dilatata
Cassidulina armosa
Cassidulina inconspicua
Cassidulina subglobosa
Cibicides pseudoconvexus
Cibicides umbonifer
Cibicides vortex
Cibicides sp. 2
Cibicides spp.
Cyclammina cf. rotundata
Dorothia cf. parri
Discorbis bertheloti var.
Discorbis sp.
Eponides tôulmini
Gaudryina (Pseudogaudryina) crespinae
Globigerina mexicana
Globigerina triloculinoides
Guttulina cf. byramensis
Gyroidina scrobriculata
Gyroidina soldanii
cf. Karreria fallax
Lagena favosopunctata
Lagena striata
Lamarckina vicksburgensis
Nonionella hantkeni
Patellina cf. corrugata
Pseudoglandulina clarkei
Pullenia bulloides
Pullenia quinqueloba
Reusella sp.
Robulus cf. limbosus var. Hockleyensis
Robulus sp.
Spirillina sp.
Spiroplectammina sp.
Sigmomorphina jacksonensis
Stomatorbina torrei
Uvigerina gracilis
Verneulina sp.

The age of this rock is upper Eocene.

C. White Well Outstation and Head of Great Australian Bight.

From Colona to White Well there were no exposures of fossiliferous rocks and the surface is covered with sandy soil and sometimes travertine at least 3 feet thick. At White Well which is at the head of the Bight, a well in Tertiary limestone

struck a small supply of salt water at the depth of 200 feet; the well shaft passed through a cave. Another bore was sunk to 700 feet; it encountered water under pressure which rose to about 200 feet from the surface. It is considered that this bore penetrated clay and a lignitic bed but definite information was not available. No spoil samples were available.

Mr. Owen visited the cliffs forming the coast west of the head of the Bight and found that the cliffs actually facing the Southern Ocean are consolidated dune-sands piled up against the face of an old sea-cliff composed of fossiliferous Tertiary limestone. Specimens (Sample 4) of the limestone exposed near the top of the cliffs and for 200 yards inshore were taken; they represent a vertical thickness of 30 feet. Other specimens (Sample 5) were collected at a point where the limestone is covered by sand hills just inshore from the end of the sandstone cliffs and represent a lower horizon than Sample 4.

Sample 4. About 5 miles west from head of Bight; sample represents 30 feet vertical cliff face.

Hard yellowish crystalline limestone with foraminifera.

Austrotrillina howchini
Marginopora cf. vertebralis
Operculina cf. victoriensis
Numerous small miliolids

Sample 5. About 4 miles west of head of Bight; lowest exposure of limestone before covered with sand.

Hard yellowish crystalline limestone with foraminifera.

Austrotrillina howchini
Marginopora cf. vertebralis
Numerous small rotalines and miliolids

The age of Samples 4 and 5 is topmost lower Miocene (f_1-f_2 stage).

D. Between White Well and the Border.

The first outcrop of Limestone along the road is at 57 miles west of White Well: sample 6 was collected from this locality.

At 82 miles west from White Well a blowhole occurs near the road. Heaps of spoil indicated that it had been cleaned out at some time, probably to give access to caves so as to deepen it for water. Samples 7, 8 and 9 were taken from the spoil dump, and Sample 10 from the limestone outcrops. This blowhole is within two or three miles of the Albala Karoo Bore which according to Jack (1930) reached bedrock at 950 feet after penetrating 600 feet of bryozoal limestone and 350 feet of bluish clay and shale.

Sample 6. Limestone outcrop 57 miles west of White Well.

Hard cream to yellowish limestone with foraminifera.

Austrotrillina howchini
Flosculinella cf. bontangensis
Marginopora cf. vertebralis
Operculina victoriensis
Textularia sp.
Numerous small rotalines.

The age of this rock is topmost lower Miocene (f_1-f_2 stage)

Sample 7. Spoil Dump, 82 miles west of White Well.

White chalky bryozoal limestone with numerous moderately

well preserved foraminifera.

Alabamina obtusa var. westraliensis
Angulogerina sp. nov.
Asterigerina adelaidensis
Anomalina perthensis
Anomalina westraliensis
Bolivinopsis crespinae
Bulimina aff. tarda
Carpenteria rotaliformis
Cassidulina cf. inconspicua
Cassidulina subglobosa var. horizontalis
Ceratobulimina sp.
Cibicides cf. perlucida
Cibicides pseudoconvexus
Cibicides umbonifer
Cibicides sp.
Crespinella sp. nov.
Dentalina cf. soluta
Discorbinella sp. 1
Discorbis cf. turbo
Eponides repandus var.
Gaudryina (Pseudogaudryina) crespinae
Globigerina triloculinoides
Globigerinella micra
Globigerinoides index
Gyroidina scobriculata
Gyroidina soldanii
Lagena laevis
Lagena favosopunctata
Lagena sulcata
Lamarckina sp.
Notorotalia stachei
Patellina cf. corrugata
Pullenia cf. quinqueloba
Spirillina sp.
Stomatorbina torrei

Sample 8. Same locality as No. 7

Hard yellowish bryozoal chalky limestone with foraminifera.

Anomalina cf. perthensis
Cibicides cf. pseudoconvexus
Globigerina cf. cretacea
Globigerina pseudobulloides
cf. Guembelina

The age of Samples 7 and 8 is upper Eocene.

Sample 9. Same locality as Nos. 7 and 8 but probably stratigraphically below those samples.

Friable grey sandstone with glauconite and a few fragments of bryozoa (derived).

Age - undertain.

Sample 10. Limestone outcrop 82 miles west of White Well.

Hard cream limestone with foraminifera.

Bolivina sp.
Elphidium sp.
Globigerina sp.
Marginopora cf. vertebralis
Operculina cf. victoriensis
Sigmoidella elegantissima
Numerous small miloilids.

The age of this rock is topmost lower Miocene (f_1-f_2 stage).

E. Eucla, Western Australia (See Plate 2).

Eucla is separated from the sea by a belt of sand hills about 400 feet wide and is about 2½ miles south of Hampton Scarp. From Eucla the ground level gradually rises to about 160 feet above sea level at the foot of the scarp. The scarp rises abruptly to 260 feet, which is the level of the plateau. At the point where the road descends the scarp to the coastal plain, road cuttings and natural exposures reveal a vertical thickness of 90 feet of Tertiary limestone. Samples were collected throughout the section.

Sample 11. 2½ miles north of Eucla.

Hard cream crystalline limestone with a few foraminifera.

Elphidium sp.
Textularia sp.
Valvulina cf. fusca
Small rotalines.

Sample 12. 20 feet down scarp, 2½ miles north of Eucla

Hard cream crystalline limestone with a few foraminifera.

Carpenteria sp.
Valvulina cf. fusca
Small foraminifera

The age of Samples 11 and 12 is topmost lower Miocene (f1-f2 stage).

Sample 13. 40 feet down scarp, 3¼ miles north of Eucla

Hard cream crystalline limestone with abundant small indeterminate foraminifera in a chalky matrix.

Sample 16. Lowest point on scarp at which limestone outcrops.

Chalky white bryozoal limestone with a few foraminifera.

Cibicides pseudoconvexus
Nodosaria sp.
Pseudoglandulina sp.
Small rotalines

Sample 15. 30 feet below No. 16 and 150 yards southwest from it. 100 yards from 444 mile peg and about 15 feet above level of road quarry.

Yellowish bryozoal limestone with small indeterminate foraminifera chiefly rotalines.

Sample 17. Exact locality label missing (See Plate 2)

Pinkish to cream bryozoal limestone partially recrystallized, with a few indeterminate small foraminifera

Sample 18. Road Cutting 70 yards east from No. 17.

Pinkish to cream, bryozoal limestone with indeterminate small foraminifera.

The age of Samples 13, 15, 17 and 18 is probably upper Eocene.

F. Between Eucla and Madura Pass.

Sample 14. East of Madura, 95 miles west of Eucla.

Bryozoal limestone with indeterminate foraminifera.

Sample 21. Scarp 95 miles west of Eucla.

Bryozoal limestone with a few small foraminifera.

The age of Samples 14 and 21 is probably upper Eocene.

G. Madura Pass.

Sample 22. Cutting, west side of road, 110 miles west from Eucla.

Hard pinkish crystalline limestone with foraminifera, Ditrupa tubes, and abundant calcareous algae.

Austrotrillina howchini
Calcarina cf. verriculata
Flosculinella cf. bontangensis
Gypsina howchini
Marginopora cf. vertebralis
Rotorbinella cf. cycloclypeus
Operculina cf. victoriensis
Numerous small foraminifera especially miliolids.

Sample collected at Madura Pass by M. H. Johnstone (MHJ.1)

Hard cream to pink crystalline limestone with calcareous algae and foraminifera.

Austrotrillina howchini
Carpenteria sp.
Marginopora cf. vertebralis
Operculina cf. victoriensis
Rotorbinella cf. cycloclypeus
Textularia sp.
Valvulina cf. fusca
Numerous miliolids.

The age of Sample 22 and MHJ.1 is topmost lower Miocene (f_1-f_2 stage)

H. Balladonia, 100 miles east of Norseman.

Sample 23. Outcrop 64 miles west of 250 mile Hut and east of Balladonia, and 186 miles east of Norseman.

Hard pinkish limestone with most organisms filled with brown glauconite, a few small indeterminate foraminifera and fragments of Marginopora.

Sample 32. Outcrop ¼ mile south of Balladonia Homestead Outcamp.

Fragmental limestone with quartz grains, calcareous algae, and foraminifera, most tests infilled with glauconite.

Flosculinella cf. bontangensis
Marginopora cf. vertebralis
Rotorbinella cf. cycloclypeus
Numerous miliolids and rotalines.

The age of Samples 23 and 32 is topmost lower Miocene (f_1-f_2 stage).

Sample 31. ¼ mile south of Balladonia Homestead Outcamp, from underground tank excavation.

Whitish bryozoal chalky moderately friable limestone with numerous foraminifera.

Alabamina obtusa var. westraliensis
Anomalina perthensis
Anomalina subnonionoides
Cassidulina armosa
Cassidulina inconspicua
Cibicides umbonifer
Cibicides vortex
Cibicides sp.
Crespinella sp. nov.
Dorothia parri
Eponides repandus var.
Eponides sp.
Globorotalia crassata
Globigerina triloculinoides
Globigerina cf. angipora
Guttulina irregularis
Guttulina cf. jarvisi
Guttulina problema
Guttulina regina aff. var. chappeli
Guttulina cf. trigonula
Gyroidina soldanii
Lagena favosopunctata
Lagena sulcata
cf. Lamarckina sp.
cf. Mississippina sp.
Parrella sp.nov. aff mexicana
Pseudoglandulina clarkei
Sigmoidella bortonica
Spiroplectammina mississippiensis
Spiroplectammina cf. nuttalli
Spiroplectammina sp.
Stomatorbina torrei
Textularia adalta
Victoriella cf. plecte

The age of this rock is upper Eocene.

I. Booanya, 27.5 miles south from Balladonia.

Samples 26, 27, and 28 come from a dump at Booanya Well which is 60 feet deep. Booanya Well is 0.4 miles from big granite rock on bearing 210°M and about 0.25 miles from granite boundary.

Sample 26 has been lost.

Sample 27 Hard pinkish bryozoal limestone with foraminifera club-shaped echinoid spines, and small brachiopoda.

Asterigerina spl nov.
Crespinella sp. nov.
Robulus cf. alabamensis
Planorbulina sp.

Sample 28. Moderately hard bryozoal limestone with numerous foraminifera, many tests encrusted with calcite.

Asterigerina sp.
Anomalina subnonionoides
Bolivinella sp. nov.
Cancris sp.
Crespinella sp. nov.
Eponides toulmini
Discorbis cf. turbo
Discorbis cf. patelliformis
Dorothia parri
Frondicularia sp.
Gaudryina (Pseudogaudryina) crespinae
Guttulina irregularis
Lagena cf. orbignyana
Miliolinella oblonga
cf. Nodobacullariella
Pullenia bulloides
Pyrgo bulloides
Pyrgo sp.
Pseudoglandulina clarkei
Parrella sp.
Reussella cf. finlayi
Reussella cf. eocena
Robulus sp.
Spiroplectammina sp.
Stomatorbina torrei

The age of Samples 27 and 28 is upper Eocene.

J. Wonberna, 12.3 miles from Telegraph Station at Balladonia.

Sample 33. 100 yards north of granite outcrop.

Hard fragmental limestone with foraminifera.

Austrotrillina howchini
Fhosculinella cf. bontangensis
Marginopora cf. vertebralis
Numerous miliolids.

The age of this rock is topmost lower Miocene (f_1-f_2 stage)

Notes on the Foraminiferal Assemblages and the Age of the Limestones.

The collection is the most systematic so far made in the Nullarbor Plains region, and Mr. Owen's notes have helped to elucidate the Tertiary problems there. The foraminiferal assemblages present in these limestones from the Nullarbor Plains have yielded valuable information regarding their age. This information is based on recent work on the Tertiaries of Western Australia and south-eastern Australia. It would seem that, in the light of present evidence as to the age of certain beds in south-eastern Western Australia, earlier collections of limestones such as that from the "Plantagenet Series" described by Chapman and Crespin (1934) should be re-examined.

Sample 1, taken from a ridge immediately north of the old Yalata Homestead, was the only one collected which is younger than Tertiary. The foraminiferal assemblage is regarded as most probably Pleistocene in age. The species present are typical of shallow warm water, and are found living in the seas along the west coast of Western Australia. The youngest known occurrences of the foraminifera as fossils eastwards from Western Australia is in deposits of Pleistocene age inthe Adelaide Basin, South Australia. The limestones at Yalata seen to be equivalent in age.

The Tertiary limestones collected west from Yalata are represented by hard foraminiferal crystalline limestones, bryozoal crystalline limestones, and white to pinkish chalky limestones. The foraminifera in these rocks indicate two ages - topmost lower Miocene (f1- f2 stage), and upper Eocene ("b" stage). The remarkable feature of the hard foraminiferal limestones and the bryozoal limestones is their lithological and faunal similarity with limestones in the Carnarvon Basin, Western Australia, the former type with the Trealla Limestone and the latter with the Giralia Calcarenite. The third type of limestone with its chalky lithology seems to be characteristic of the Nullarbor Plains region.

(1) Hard foraminiferal crystalline limestone.

This rock is widespread, both in outcrop and immediately underlying the travertine deposits, on the Nullarbor Plains. The samples included under this heading are Nos. 2 (1), 4, 5, 6, 10, 11, 12, 22, 23, 33, and MHJ.1. The best sections are at Madura Pass and on the Hampton Scarp near Eucla. The limestone contains an assemblage of foraminifera which is found in the Trealla Limestone of the Carnarvon Basin and is typical of "f_1-f_2" stage in Indo-Pacific Tertiary stratigraphy. It is equivalent in age to the upper part of the lower Miocene. The characteristic foraminifera include Austrotrillina howchini, Marginopora cf. vertebralis, and Valvulina cf. fusca, together with numerous miliolids. The presence in Sample 22 of Flosculinella cf. bontangensis, Calcarina verriculata, and Gypsina howchini, as well as the species mentioned above, suggests that these rocks may be slightly lower stratigraphically than the rocks without those three forms.

This microfaunal assemblage extends as far eastward as the "old Murray Gulf" in north-western Victoria and south-western New South Wales, where it is well developed in subsurface sections. Moderately hard limestone with the same microfauna is also found in some of the Adelaide Metropolitan bores where it is referred to as the "Oakland Limestone" (Crespin, 1954).

2. Hard bryozoal limestone.

Rocks of this lithology and faunal assemblage are samples Nos. 2 (2), 8, 13, 15, 16, 17, 18 and 21. In the Eucla section, they directly underlie the hard foraminiferal limestones described

above. Small foraminifera are difficult to determine in thin section, but forms such as Anomalina cf. perthensis, Cibicides cf. pseudoconvexus, Globigerina pseudobulloides, and Globigerina cf. cretacea have been identified. Bryozoa are exceedingly common. The lithology is characteristic of that found in the Giralia Calcarenite in the Carnarvon Basin. The occurrence of similar bryozoal limestones in such widely separated areas suggests the widespread influence of Indo-Pacific Tertiary conditions of sedimentation as far east as western South Australia. There is little doubt that these rocks are upper Eocene in age.

3. White and pinkish moderately friable chalky limestone.

This rock is represented in samples Nos. 3, 7, 16, 27, 28 and 31. Many of the limestone samples are rich in foraminifera, the majority of the tests being well preserved and unusually large. Many well known upper Eocene species are represented. Some have been described from the King's Park Bore, Perth, (Parr, 1938) and others from Eocene deposits in America and elsewhere. Some species are new, although they have been recorded from upper Eocene deposits in the Carnarbon Basin and in the Maslin Beach section in South Australia. Very common in the assemblage is a new species of Crespinella recently recorded in some abundance at Maslin Beach (Crespin, 1954). It has also been found associated with Discocyclina in the Carnarvon Basin. Another important form is Asterigerina adelaidensis which is rperesented by beautifully preserved specimens. It was described by Howchin from the basal part of the section in No. 2 Bore, Kent Town, Adelaide (1891), and is now recognised as an important zonal form for the upper Eocene. It also occurs in the upper Eocene deposits of south-western Victoria. A small specimen of Victoriella cf. plecte Chapman was discovered in sample No. 31. It has been found with Crespinella sp. nov. and Discocyclina in the Carnarvon Basin. Large tests of a new species of Bolivinella are common in sample No. 28 from Booanya Well.

Small upper Eocene species include Alabamina obtusa var. westraliensis Parr, Anomalina perthensis Parr, Anomalina westraliensis Parr, Angulogerina subangularis Parr, Bolivinopsis crespinae Parr, Cassidulina inconspicua Hussey, Cassidulina armosa Bandy, Cibicides umbonifer Parr, Cibicides pseudoconvexus Parr, Eponides toulmini Brotzen, Globigerina mexicana Cushman, Globigerinoides index Finlay, Globigerinella micra(Cole), Pseudoglandulina clarkei Parr and Sigmomorphina jacksonensis Cushman.

A feature of the limestone from Booanya Well is the presence of a large number of club-shaped echinoid spines, to which Chapman and Cudmore (1934) make reference. (985 specimens were made available to them from this locality.) It is interesting to note that all the localities from which these authors recorded this form are now regarded as upper Eocene in age.

Conclusions.

The following points have been brought out by this investigation of the limestones in the coastal region of the Nullarbor Plains.

1. The lithological similarity of the limestones with those of the same age in the Carnarvon Basin.

   (a) The wide-spread distribution in the Nullarbor Plains region of the same lithological type as the Trealla Limestone of the Carnarvon Basin of Western Australia.

   (b) The similarity of the bryozoal limestone lithology, especially in the Eucla section, with parts of the Giralia Calcarenite of the Carnarvon Basin.

2. The similarity of the faunal content of the limestones in the Nullarbor Plains region with that in limestones in the Carnarvon Basin, and in the Adelaide Basin and the Aldinga area (Maslin Beach), South Australia, as well as in north-western Victoria and south-western New South Wales.

(a) The "f1-f2" foraminiferal assemblage with Austrotrillina howchini in the hard foraminiferal imestone is identical with that found in the Trealla Limestone of the Carnarvon Basin (Condon et el, 1954) and in the Oaklands Limestone (Crespin, 1954) of subsurface deposits in the Adelaide Basin, South Australia, and in subsurface deposits of north-western Victoria and south-western New South Wales (Chapman, 1916).

(b) The foraminiferal fauna in the hard bryozoal limestones is identical with that found in the Giralia Calcarenite of the Carnarvon Basin, which is upper Eocene in age.

(c) The microfauna of the chalky limestones with its abundant Crespinella sp. nov. is correlated with deposits at Maslin Beach (Blanche Point Limestone, Crespin, 1954) South Australia, and with certain beds in the Giralia Calcarenite. A further link with the Adelaide-Aldinga Tertiary deposits is the occurrence of Asterigerina adelaidensis. Numerous small foraminifera also indicate an upper Eocene age for the beds.

3. The stratigraphical sequence of upper Eocene and lower Miocene is similar to that found in the Giralia Anticline in the Carnarvon Basin, in the Adelaide Basin, and even as far east as the Torquay section in central southern Victoria.

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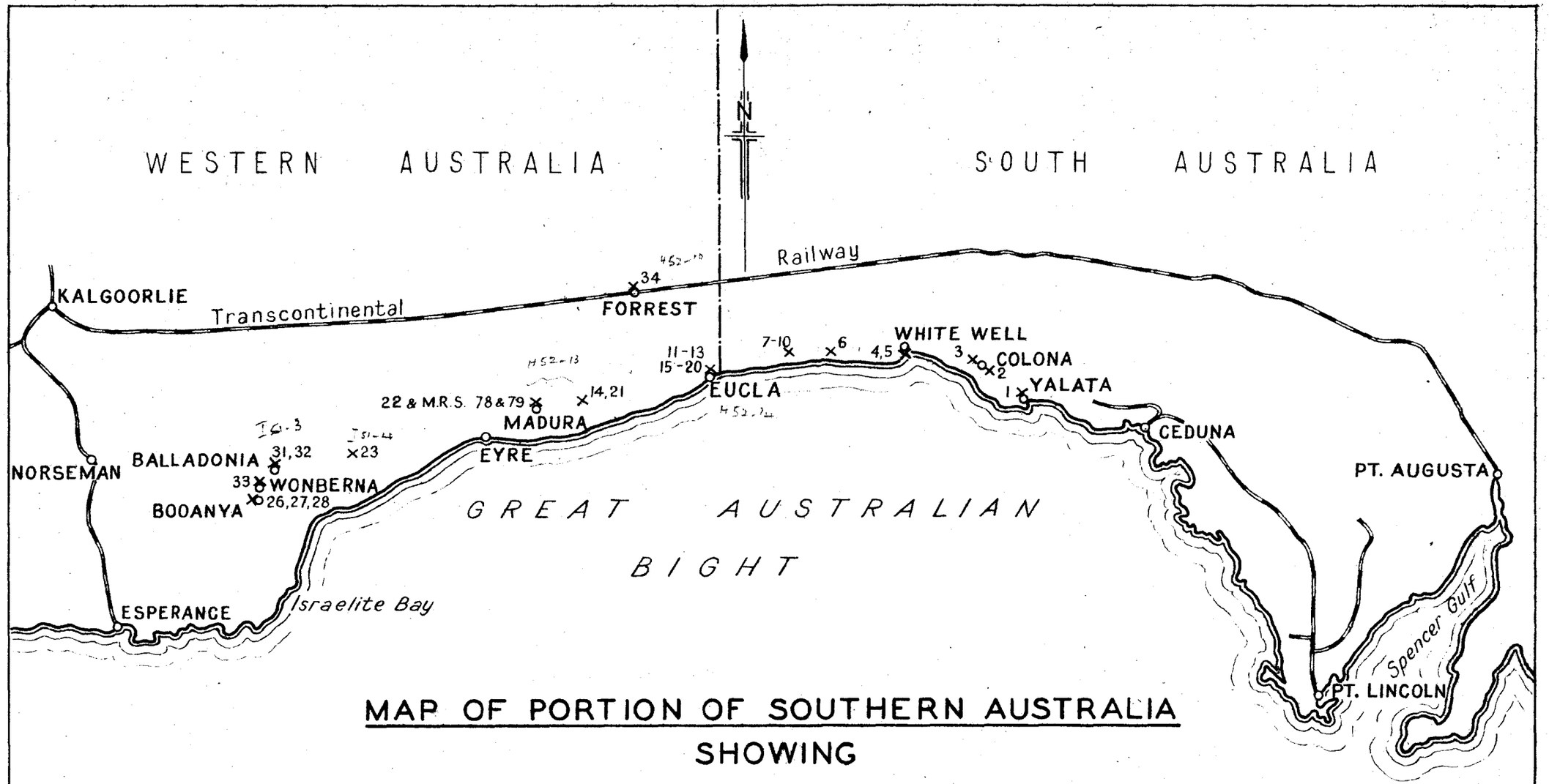


MAP OF PORTION OF SOUTHERN AUSTRALIA
SHOWING
LOCALITIES OF SPECIMENS
COLLECTED FOR MICROPALAEONTOLOGICAL EXAMINATION

Scale

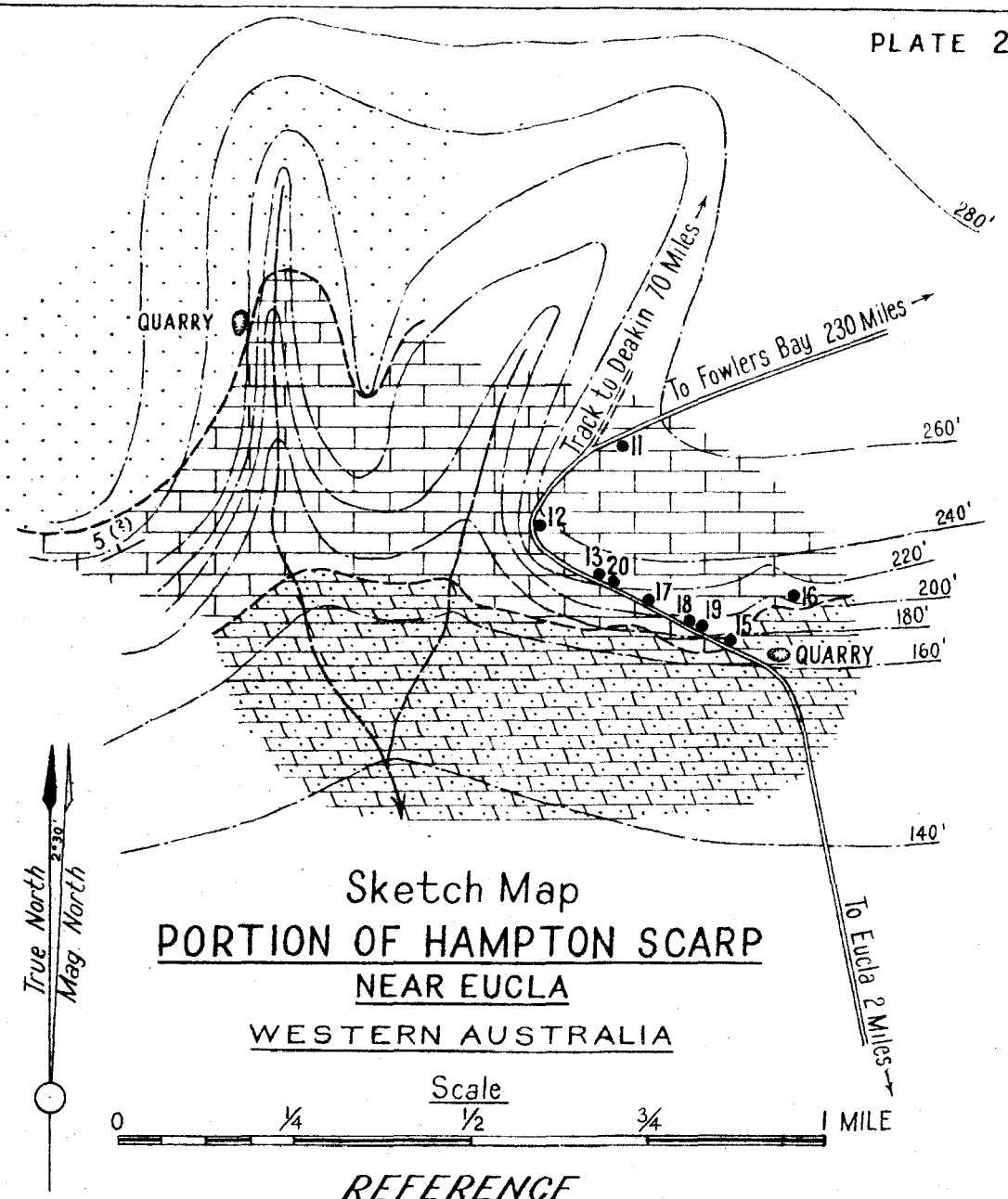
100 0 100 200 300 400 500 Miles

Mineral Resources Survey. 20·9·44 Geologist H.B.Owen

WA 52-1
NK

PLATE I

PLATE 2



Sketch Map
PORTION OF HAMPTON SCARP
NEAR EUCLA
WESTERN AUSTRALIA

Scale

0 — ¼ — ½ — ¾ — 1 MILE

REFERENCE

Recent	Travertine and sand	●12 . Specimens for palaeontological examination
Recent or Pleistocene	Sandstone	——— Geological boundaries
Tertiary	Limestone	260' Form lines; Datum sea level

Mineral Resources Survey 11·9·1944 Geologist H.B.Owen

WA 52-2
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