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DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

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by

J.M. LINDSAY
Assistant Senior Palaeontologist
Palaeontology Section

Rept.Bk.No. 70/192
G.S. No. 4576
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ABSTRACT

A thickness of approximately 112 feet of Port Willunga Beds is exposed in coastal outcrops and is comparable with the type-section at Port Willunga. The age as determined by planktonic foraminifera, ranges from Upper Eocene to middle Oligocene. An important echinoid fauna is thus dated.

INTRODUCTION

The Beds crop out in low coastal cliffs, shelves, and "reefs", from the estuary at the mouth of the Onkaparinga River southwards to Seaford (Fig. 1). Port Noarlunga is some 16 miles south-southwest of the City of Adelaide. The thickness of the strata has been measured by tracing marker beds, a composite stratigraphic column has been compiled, and foraminifera have been used to date the sequence (Fig. 2). This section is part of the shallow-dipping northern limb of the asymmetric syncline plunging west-southwest through the Noarlunga Sub-Basin of the St. Vincent Basin (Glaessner and Wade, 1958, Fig. 24; Wade and Lindsay, 1969, Fig. 1). The section on the more steeply-dipping southern limb of the syncline, exposed near Moana, is not dealt with here.

Further south in the adjoining Willunga Sub-Basin Reynolds (1953) was the first to name formally (from classic coastal exposures) a succession of distinctive rock units including the Port Willunga Beds. These Beds were the upper part of Tate's "Lower Aldinga Series" and were dated at first Lower Miocene (Tate, 1879, p. 1 iii) but later, Eocene (Tate and Dennant, 1896) and Upper Eocene (Tate, 1899). Almost all dates subsequently given were between these same limits. Affinities with the Victorian Janjukian Stage were often proposed.

In 1966, the writer (see Ludbrook and Lindsay, 1966) found the Eocene planktonic foraminifer Subbotina linaperta (Finlay) in the lower part of the type-section of Port Willunga Beds, and an Eocene and Oligocene (Aldingan and Janjukian) age was proposed for the section. In a more detailed re-assessment (Lindsay, 1967) about 107 feet of the Port Willunga Beds were dated in part Upper Eocene, Aldingan Stage (Turborotalia aculeata Zone, 22 feet; Subbotina linaperta Zone, 22 feet) and in part Oligocene, mostly pre-Janjukian Stage (Chiloguembelina cubensis Zone, 56 feet; Guembelitria stavensis Zone, 7 feet).

Many have noted similarities between Port Willunga Beds at Port Willunga and those near Port Noarlunga. Most recently this was emphasized by Stuart (1967), who recorded about 120 feet of the Beds "along the coast in the Noarlunga and Willunga Sub-Basins", and concluded that "an equal thickness of these sediments was once continuous between the two basins". However documentation of the Tertiaries near Port Noarlunga has

lagged behind that at Port Willunga, and publication of some notes on the former's Port Willunga Beds is desirable for several reasons:

1. They are well-exposed and readily accessible (best at low tide), enhancing their scientific and educational value.
2. They provide a vital link between the type-section and sub-surface development in the Adelaide Plains Sub-Basin (Lindsay, 1969).
3. A need arose to date and put in stratigraphic perspective important echinoid faunas which have been collected from within the sequence over many years.
4. There was the opportunity to test this further section against recent advances in planktonic foraminiferal biostratigraphy here and overseas (McGowran et al., 1971; Blow, 1969, 1970).

ROCK UNITS AND SAMPLES

Chinamans Gully Beds

These disconformably overlie Blanche Point Soft Marls (as they do near Port Willunga) and crop out near water level for about 100 yards south of the footbridge. They are 5 or 6 feet thick, red/brown/grey/green in colour, and comprise clay, silt, and cross-bedded bioturbated sandstone.

Port Willunga Beds

The sequence disconformably follows Chinamans Gully Beds and is recognizably similar to that at Port Willunga (Reynolds, 1953; Stuart, 1967; Lindsay, 1967).

"Aldingan unit"

F.174/70: well-bedded bryozoal calcarenite/ calcirudite, coarsely quartzose, more or less calcareous-cemented, fawn/pale brown/pale grey, comparable with basal sands of the type section.

F.173/70, F.2/70: bryozoal marly calcarenite/ calcirudite, yellow/brown/pale grey-green.

F.1/70: firm bryozoal shelly marl, silty, glauconitic, pale green.

F.185/70: compact marl to marly limestone, quartzose (silt, sand), glauconitic, grey/brown/green, shelly, bryozoal.

The beds dip about 1^{o} south.

The unit is thinner here than at Port Willunga (29 feet against 44 feet), and in particular the aculeata Zone is thinner (9 feet against 22 feet).

"Siliceous unit"

As at Port Willunga (and subsurface, Adelaide Plains) this stratigraphically-distinct unit is characterized by beds of spicular siliceous marls, marlstones, and limestones, bearing cherty concretions.

F.176/70: cherty concretion from "first siliceous marker bed", fawn/brown/pale greenish-grey, with mould of small Turritella. Thin-section petrography by R. Davy (unpub. AMDEL Report MP. 1682-71) disclosed 65-70% opaline silica (with minor zeolite) as dirty brown matrix and sponge spicules, besides 15-20% quartz grains (coarse silt to fine sand), 15% glauconite (mainly glauconitized faecal pellets) and 1-2% opaques and iron oxides.

F.177/70: compact, rather leached, spicular mudstone

with hard cherty concretions; quartzose (silt, very fine sand), glauconitic (common ovoid faecal pellets), pale greenish-grey/ fawn/brown; sponge spicules and spicular casts common; Turritella casts small, rare.

Several particularly resistant bands of this unit slant seawards to form "reefs" (Figs 1, 2). Their dip is 1^{o} - 2^{o} southwest.

Samples have mostly been taken from the softer beds:

F.184/70: firm marl; grey/brown/green, glauconitic, bryozoal, shelly, spicular.

F.179/70: mudstone; grey/brown, soft, leached of carbonate, with abundant sponge spicules, glauconitic.

F.3/70: bryozoal marl, marly limestone; pale grey, quartzose (silt, very fine sand).

F.180/70: siliceous spicular mudstone, brown, leached; with milky grey fossiliferous chert and green glauconite.

F.4,5/70: bryozoal marls; fawn, grey, speckled with dark green glauconite, quartzose (silt, fine sand).

F.183/70: bryozoal calcarenitic marly limestone, marl; silty, fawn/brown/dark green, glauconitic.

The unit is thicker here than at Port Willunga (71 feet against 52 feet).

"Upper (Janjukian) unit"

F.6/70: bryozoal limestone, marly; soft, friable, quartzose (silt, fine sand), fawn, poorly glauconitic.

The thickness exposed (approximately 12 feet) is about the same here as in the type section.

FORAMINIFERAL BIOSTRATIGRAPHY AND AGE OF THE SEQUENCE

Relative abundances of foraminifera in Fig. 2 are based on reasonably thorough routine picking of the washed residue of roughly 100 ccs. of sediment. Leaching of carbonate (including foraminifera) has occurred in F177, 179, 180/70.

F174/70 contains benthonics (Maslinella, Halkyardia, Crespinina, Gen. cf. Bolivinella) not known from above the Eocene in South Australia.

The samples with Turborotalia aculeata (Jenkins) are both within the range of Globigerina ampliapertura Bolli, as is the case at Port Willunga (Lindsay, 1967). They should be therefore no older than Zone P.17 (Blow, 1969). McGowran et al. (1971) set the topmost part of the aculeata Zone against earliest P.17, late in the Upper Eocene.

Rather convincing Globigerina sp. aff. G. angulioficinalis Blow occurs with S. linaperta in F185/70. This also suggests that the linaperta Zone is no older than P.17 as G. angulioficinalis only ranges upwards "from the later part of Zone P.17" (Blow, 1969). However Blow does not recognize S. linaperta above Zone P.16, and this remains a point of disagreement with local and New Zealand data.

The pre-Janjukian Zone of Subbotina angiporoides (Ludbrook and Lindsay, 1969) is developed better here than at Port Willunga. Blow (1970) now ranges S. angiporoides (Hornibrook) and Cassigerinella eocaenica (Cordey) into his newly-combined Zone P.19/20, of "approximately middle Oligocene age" (Rupelian).

The Chiloguembelina cubensis Zone here has a span not much different from the angiporoides Zone, while the range-top of the zone species is evidently much lower than "the earliest part of N.4" (Blow, 1969) and apparently little if at all above Zone P.19/20 on the evidence of S. angiporoides, T. gemma (Jenkins), and C. eocaenica. The topmost part of the cubensis Zone in southern Australia is earliest Janjukian (Carter 1958, 1964; Lindsay, 1967).

While the Guembelitria stavensis Zone was put in Zone P.21 by McGowran et al. (1971) the presence of T. gemma in F6/70 suggests that the base at least of the stavensis Zone is no younger than P.19/20 (Blow 1969, 1970).

Species diagnostic of Zone P.18 are lacking. If Cassigerinella chipolensis (Cushman and Ponton) does not appear before P.18 (Blow, 1969) then F1/70 could be P.18. However S. linaperta is also present at this level both here and at Port Willunga, and indicates Zone P.17 more strongly.

The "only ..... reasonably unambiguous evolutionary event" (Blow, 1970) within Zone P.19/20 is the development of Globigerina ciperoensis Bolli "forma typica". Samples from F3/70 upwards which have populations of the Globigerina angustiumbilicata - Globigerina ouachitaensis complex, yield occasional individuals which approach this form. The first appearance of high-spired, compact, G. ciperoensis "forma atypica" in F183/70 is, on other evidence, earlier than the Zone P.22 level initially recorded by Blow (1969).

ECHINOIDS

Philip and Foster (1970) outlined a sequence of seven echinoid faunas in the Cainozoic of southeastern Australia. The section between F2/70 and F6/70 is a standard locality for their Fauna B. Mr. Foster has kindly supplied the following notes:

"The common echinoids of the first prominent shelf at the Onkaparinga mouth are the large spatangoid Schizobrissus decipiens (Tate), and the holasterid Corystus dysasteroides (Duncan). Eupatagus sp. nov. is present. Rare are a small temnopleurid gen. et sp. nov. with star-shaped marsupium, and a moderately large cidarid cf. Stereocidaris cudmorei Philip.

"The start of Fauna B can be recognized by the advent of Schizobrissus, Corystus ("Duncaniaster") and Eupatagus.

"In the brown fossiliferous bed ['yellow shelf', Fig.2] south of Onkaparinga Trig. the dominant echinoid is Eupatugus murrayensis Laube. Common are fragmentary tests of the small Gonoicidaris murrayensis Chapman and Cudmore, spines and isolated plates of the large Stylocidaris scoparia (Chapman and Cudmore), and the marsupiate temnopleurid Paradoxechinus sp.nov. Also present are Brissopsis sp. aff. B. tatei Hall, and small dumb-bell shaped spines of Eucidaris sp.; but not yet Lovenia".

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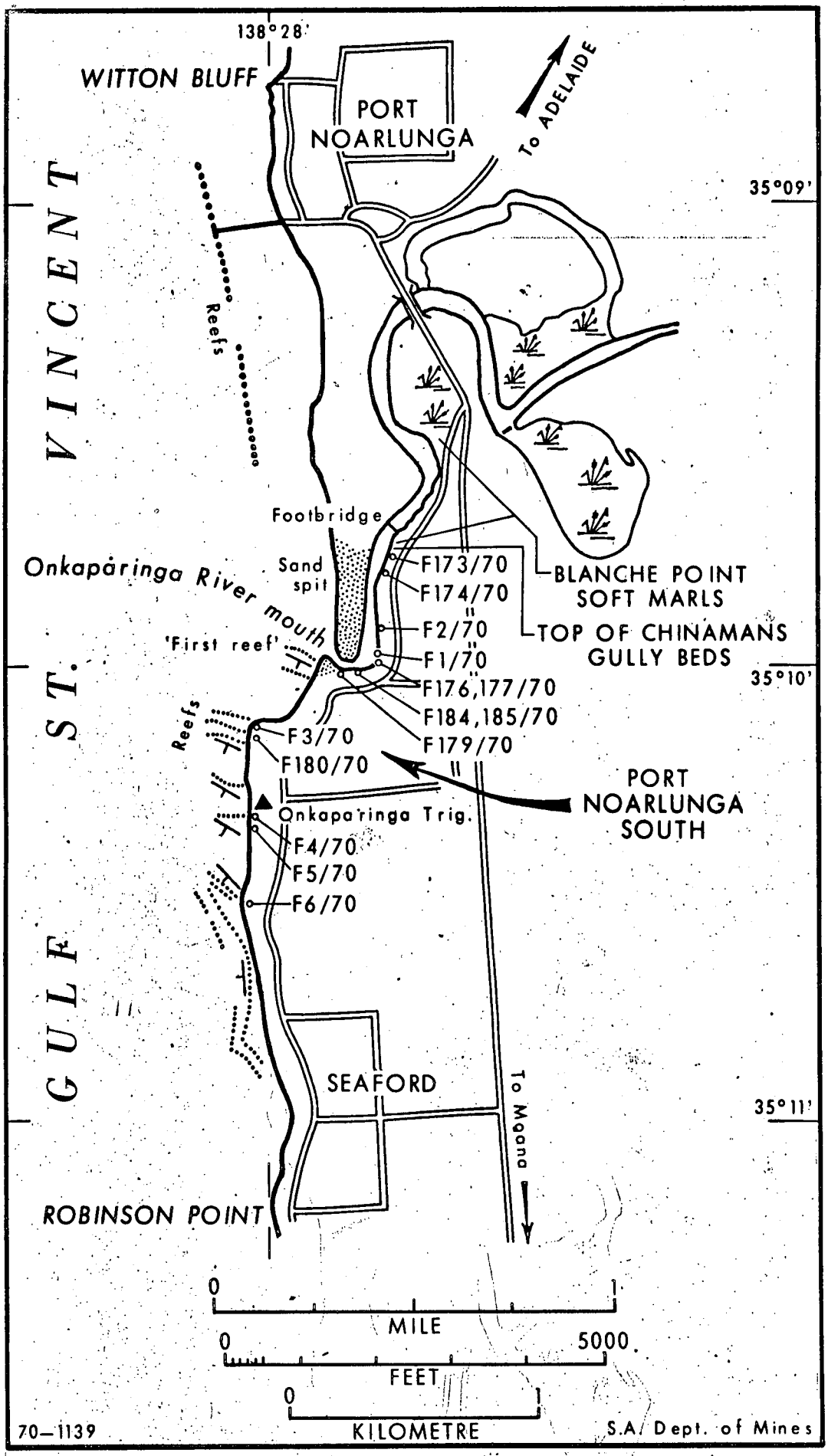

Fig. 1 Locality Map

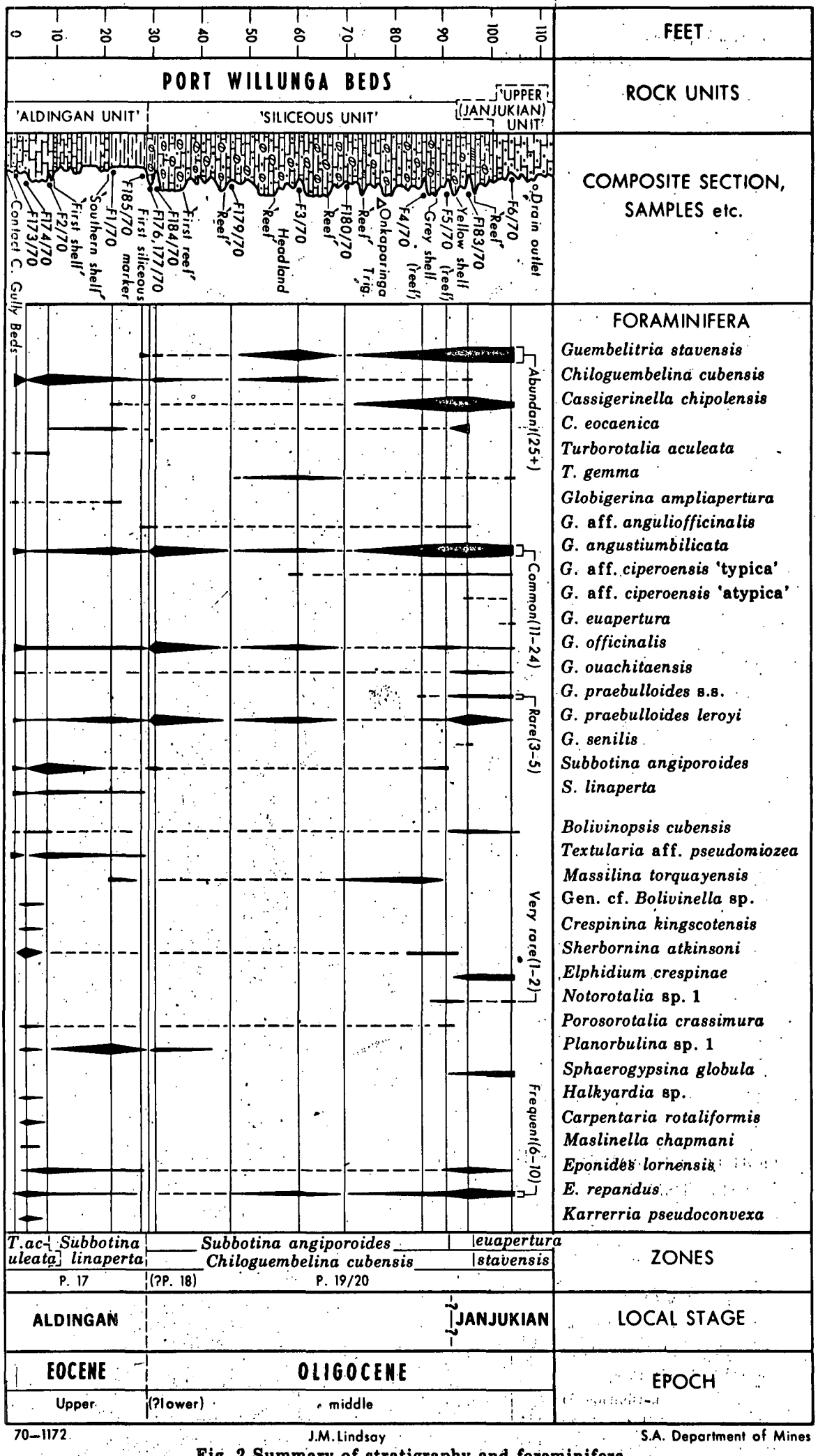

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Fig. 2 Summary of stratigraphy and foraminifera