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ON NEW SPECIES OF *BELEMNITES* AND  
*SALENIA* FROM SOUTH AUSTRALIA.

ON NEW SPECIES OF BELEMNITES and SALENIA from the MIDDLE TERTIARIES of SOUTH AUSTRALIA. By RALPH TATE, Esq., F.G.S., Assoc. Linn. Soc., Professor of Natural Science in the University of Adelaide.

CONTRARY to my determination not to publish any facts connected with the Middle Tertiaries of South Australia until I could present a detailed account of them, and of their palæontological characters, I herein communicate to the Geological Society the discovery of the presence of two genera in these rocks, which, on account of their distribution in time in European strata, must be regarded as of especial interest.

A species of Belemnite (*Belemnites rugifer*) has been recorded from the Older Tertiaries of Ronca, in Northern Italy; but the occurrence of the genus in the South-Australian Tertiaries greatly extends its duration, inasmuch as the epoch of the deposition of the River-Murray beds is generally regarded as not older than Miocene, and by some is placed in the Pliocene period. I refrain from offering an opinion on this question, as hitherto the corals and echinoderms only have been critically examined. At this time I am engaged in comparing the fossils of the South-Australian Tertiaries with existing forms, particularly those inhabiting the South-Australian shores. This task is rendered great from the circumstance that there is no available collection in this colony for study, and I have been obliged to supply the deficiency by my own labour. But this has borne good results, as I have added 78 unrecorded marine shells to Mr. Angas's list (Proc. Zool. Soc. 1867), some of which occur in the Middle Tertiary beds, and I have made several important additions in other departments of marine zoology.

The discovery of a Tertiary *Salenia* very happily bridges over the hiatus that separates in time the newly discovered living example obtained by Sir Wyville Thomson during the cruise of the 'Challenger' ('Academy,' June 3). Though much good work has been done by Professor Duncan and Dr. Laube in making known the Echinoderm-fauna of our Tertiaries, yet the number of species recorded by them does not represent a moiety of those which I have met with. The additional genera represented are *Fibularia*, *Laganum*, *Brissus*, *Cardiaster*, *Cidaris*, *Echinanthus*, *Hemiaster*, *Pygorhynchus*, *Echino-brissus*, *Glyptocrinus*, *Meoma*, *Arachnoides*, *Astrogonium*, *Pentacrinus*, and *Comaster*.

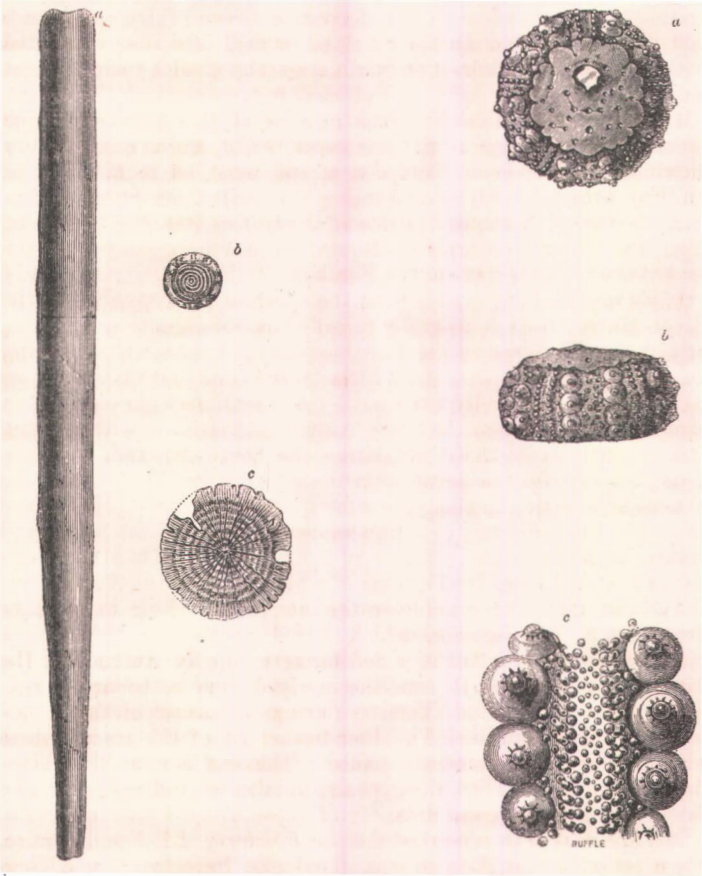
The locality at which the new species herein described have been collected is Aldinga, 26 miles south from Adelaide, on the east coast of St. Vincent's Gulf. The general assemblage of fossils in the very diversified strata displayed in the long stretch of sea-cliffs about 150 feet high at this place, is identical with that of the River-Murray beds.

**BELEMNITES SENESCENS**, spec. nov. Fig. 1.

Guard elongated, slender, gradually tapering to an acute apex, cylindrical, but inclined to subquadrangular in section, especially

Fig. 1.—*Belemnites senescens*,  
Tate.

Fig. 2.—*Salenia tertiaria*,  
Tate.



- a.* View of the most perfect specimen obtained, natural size.  
*b.* Its proximal end.  
*c.* Section of another specimen, enlarged.

- a.* From above, enlarged.  
*b.* From the side, enlarged.  
*c.* An ambulacrum, still more enlarged.

towards the alveolar region; without grooves or furrows. Length from 12 to 15 times the width. Alveolus imperfectly known, apparently shallow, with a broadly obtuse base (?).

Dimensions of longest example—length  $4\frac{1}{2}$  inches, diameter  $\frac{3}{10}$  of an inch.

No perfect specimen has been obtained; and the guard is usually in a fragmentary state, often incrustated with Polyzoa and mined with galleries of a boring animal. But the physical features of the stratum in which they occur, a calcareous sand full of débris of Polyzoa, and often exhibiting false-bedding, serve to explain their present condition, which is not derivative beyond the circumstance that they have been drifted in shoal water. *Belemnites senescens* occurs also in the River-Murray cliffs, associated with their common fossils.

I have a Belemnite from the interior of this province which resembles *B. gingensis* of the European Oolite, and is consequently unrelated to *B. senescens*, and a new species allied to *B. australis*, Phillips, obtained with other Jurassic (?) fossils from Stuart's (formerly Cooper's) Creek, on the line of the transcontinental telegraph.

*SALENIA TERTIARIA*, spec. nov. Fig. 2.

Form with the characters belonging to the genus, hemispherical, depressed, moderately inflated below, base concave; mouth not large, nearly circular; anus subhexagonal, disk with shagreen-like ornamentation, suranal plate smaller than the genital plates. Each *interambulacral area* with 12 crenulated *tubercles* in two vertical rows. *Poriferous zones* straight, *ambulacral areas* margined with *large granules*, between which are two rows of smaller ones, amongst which are scattered granulations.

Diameter of largest specimen  $\frac{6}{10}$  of an inch, height  $\frac{5}{10}$ .

#### DISCUSSION.

The PRESIDENT remarked upon the interest attaching to the discovery of this Belemnite, which added another to the curious examples of the survival of older forms of life in Australia. He thought it could hardly have been derived from Secondary strata. The *Salenia* was evidently Tertiary; and as it was somewhat Cretaceous in its aspect, it added another to the list of Cretaceous forms which outlived the Cretaceous period. This and similar discoveries showed the impossibility of comparing Australian and English strata on purely palæontological data.

Mr. J. S. GARDNER remarked that the discovery of Belemnites at so late a period as the Miocene was of extreme importance, as adding another to the list of Cretaceous forms found still surviving at a late period. If Belemnites &c. lived on until the Miocene, might not Ammonites have lived on until the Eocene? In America there are Cretaceous beds, known as Cretaceous from the presence of Ammonites and other forms, but the *facies* of whose fauna mainly resembles that of our Eocene. Floras mingled with these are known as Cretaceous floras. Should the presence of the incoming Eocene mollusca be taken to fix the age of the beds, and the Ammonites be considered to have survived in those regions to a later period, the floras would no

longer be considered Cretaceous, and the arguments for and against evolution in Dicotyledons based upon the age of these plant-types would be greatly modified.

Mr. A. W. WATERS said that two years ago he exhibited to the Society Belemnites from Ronca. Since then it has been shown by M. Bayan and Prof. Hébert that in the deposit at Ronca there are rolled fossils from the still older Tertiary beds; but the Belemnites are not rolled. Although there is every possibility that they may be Tertiary, it is by no means certain. Some geologists think that they resemble Liassic forms; but they certainly are not similar to Mr. Tate's Belemnites.

Rev. J. F. BLAKE remarked that Mr. Tate's Belemnites were more like Oolitic than Cretaceous forms; and they certainly did not belong to the genus *Belemnitella*. The interest of the case, as the President had pointed out, consists in the carrying on of Cretaceous life into Tertiary times; and this favours the idea of a non-uniform deposition of beds, and a more continuous succession of life in Australia than in Europe.

Prof. T. RUPERT JONES said that, in 1857, Belemnites found in a Tertiary deposit of North-west Germany were exhibited at the meeting of the Naturalists' Association at Bonn.

Prof. SEELEY remarked that it was impossible, from the material before the Society, to determine the species to which the *Belemnites* might belong. The characters were not sufficiently clear to show whether it was a true *Belemnites*, or ought to form a distinct but allied genus. He agreed with Mr. Gardner with regard to the resemblance of American Cretaceous shells to those of the English Tertiaries.