7. *A Twinned or Double Fossil Shell of Rotalia*

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Among the many well preserved fossils of marine origin collected sometime ago from the subsurface rock formation of the ground of the Tainan Higher Technological College, there are, in association with numerous minute molluscan shells, a number of forms of foraminifers, including species of some genera as *Quinqueloculina*, *Spiroculina*, *Nonion*, *Elphidium*, *Rotalia* and so forth.¹⁾ A brief note describing the interesting occurrence, in this faunule, of small pelecypod shells bearing the testimony of having been attacked by certain gastropods, was prepared by me in 1933²⁾

While picking up, under microscope, tiny tests of the foraminifers and other fossils from the sieved out residue of the soft sandy clay, I happened to find a single specimen of a twinned or duplicate shell of *Rotalia* which, I think, may be a form identical with, or, at least, very closely allied to, *Rotalia gaimardi* D'ORBIGNY (= *R. papillosa* BRADY var. *compressiuscula* BRADY,³⁾) a species which is quite common in the younger Tertiary and later formations of Taiwan.⁴⁾

The duplicity in foraminifers, living and fossil, seems by no means a very rare phenomenon,⁵⁾ but it may not be useless to

1) HAYASAKA:—臺南市附近砂丘基底の地質資料 (Geological Materials of the Substratum of the Dune Formation around Tainan). Taiwan Tigaku Kizi, 3, (1932), p. 110.

2) HAYASAKA:—Fossil Occurrence of Pelecypod Shells Bored by Certain Gastropods. Mem. Fac. Sci. & Agr. 6, 4, (Geology, No. 5) (1933).

3) Challenger Report, 9, P. 108, pl. CVII, fig. 1; pl. CVIII, fig. 1. (1884).

4) H. YABE and S. HANAZAWA:—Tertiary Foraminiferous Rocks of Taiwan (Formosa). Sci. Rep. Tôhoku Imp. Univ., (2) (Geology) 14, 1. (1930).

5) J. J. GALLOWAY:—A Manual of Foraminifera (1933), p. 34.

record here the fossil occurrence of an example from Taiwan.

The twinning in the specimen under consideration takes place in such a manner that two shells are brought into contact with their dorsal sides, the apical parts being partly fused together and having the ventral or apertural sides directed outward, thus the dextrality and the sinistrality of volution being represented simultaneously. The pictures in the text-figure may supplement this compendious description. The sutures on the ventral surface are rather deep and ornamented with a granulation along the sides. The limbate nature of the dorsal sutures is recognized fairly well under microscope, although it is not easy to realize it in these pictures.

Text-figure 1. A Twinned fossil of *Rotalia*, viewed from three different sides. About 27.5 times natural size.

- a. Ventral view, with the aperture on the right side, open upwards.
- b. Amalgamated dorsal parts of the two individual shells.
- c. Apertural side, showing that the apertures of the two individual shells become continuous over the amalgamated peripheral margin: the compound aperture is directed upwards just like in a.

The double specimen is, or rather each half is notably smaller than the average size of the species that are found together.

The picture (a) is a lateral view of the twinned specimen. The middle (b) and the lower (c) pictures show that the planes of volution of the two parts or individuals are not parallel to each other; the peripheral margins become united and amalgamated where the planes of volution approach each other. Here the aperture of the double specimen is situated. Turning again to the picture (a), we see, on the right side, the aperture of one half of the specimen. It is important to see that there is the aperture of the other half on the opposite side of the twinned specimen, exactly corresponding in position to the one observed in the picture. This seems to show that while the two shells that were almost at

the same phase of developement were drawn close together and united, the protoplasm of both the life to individuals endeavoured to reduce the life to single.⁶⁾

Further, the apertures of the two halves in reality become continuous over the amalgamated peripheral margin described above. This is shown in the picture (c), though unfortunately it is not an excellent one.

化石 *Rotalia* の雙生標本 (摘要)

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臺南高等工業學校敷地の下に産する無数の化石中に唯一個であるが、*Rotalia* の雙生標本がある。これは *R. gaimardi* D'ORBIGNY であらうと思はれる。雙生の仕方は、二つの殻が背面で癒着した形であるが、外側に向いた殻口は殻の縁を越えて連続して一つの細長い口となつ居る。これを見ると、同じ程度に發達した二つの個體が次第に互に引き寄せられて、二個體の protoplasma が一つの生體とならうとしたものゝ様に思はれる。

6) An explanation of "plasmogamy" in foraminifers is given by J. J. LISTER in LANKESTER's Treatise, Part I (1903), p. 125. It seems to suggest the process of duplication of the fossil *Rotalia* under consideration to be as here inferred.