

Such characters as size, specific gravity, chemical stability, and solubility all influence transportation and subsequent preservation of the mineral grains which go to form sediments. The manner of disintegration of the parent rock is of importance in determining the initial size of grains derived from it. The agent of transport, whether wind or water, takes charge of the loose grains, and sorts or mixes, preserves or destroys, according to its particular attributes of speed, temperature, and composition. Solution after deposition may sooner or later remove the far-travelled remnant. These and other principles were passed in review. Finally, a most interesting discovery was announced. All the way from Sutherlandshire and the Orkney Isles, in the north, to Yorkshire, in the south, sandstones and grits, ranging in age from Pre-Cambrian to Triassic, are apt to yield deep purple-coloured zircon in beautifully rounded grains; and this zircon has almost certainly been derived from some area lying outside of Britain.

CORRESPONDENCE.

THE AMMONITE SIPHUNCLE.

SIR,—In his interesting paper on the “Ammonite Siphuncle” in last month’s *GEOLOGICAL MAGAZINE*, Dr. A. E. Trueman rejects my suggestion (adapted after Pictet, etc.) that a (not *the*) function of the siphuncle in *Nautilus* was to afford a means of attachment of the animal to its shell. I would gladly welcome a theory that explains all the facts (which my suggestion does not do), but, unfortunately, Dr. Trueman does not offer a better explanation. He considers as more reasonable, however, the opinion of Drs. Foord and Woodward, who had suggested that the siphuncle was “of more importance in the young, perhaps then serving for attachment . . .” Thus, it may be attachment after all, and the objections that I would adduce against my own explanation, Dr. Trueman does not mention, namely, (1) that histologically the siphuncle of *Nautilus* is not a ligament, and (2) that the concentric muscle-lines indicate a gradual shifting of the shell-muscles during growth, concurrently with the secretion of gas. But, while perfectly willing to admit that in some primitive Nautiloids and also in the young of Ammonoidea (which then had simple septa) the evidence of attachment is, perhaps, stronger, I do not think that we are justified in assuming, as Dr. Woodward did, that the function of the siphuncle is performed, in the adult *Nautilus*, by the shell-muscles, as though these structures were not present in the young. Nor is there any evidence that the siphuncle is of less functional importance in the recent *Nautilus* than in a homœomorphous Silurian shell, or again in a Cretaceous Ammonite than in a Devonian Goniatite.

My contention was that during a forward move of the shell-muscles (the peculiarly pitted appearance of the scars in some

fossil forms suggests a more secure attachment than in the living *Nautilus*) some additional means of attachment was useful, and that this was supplied by (but not the only function of) the penetrating fibres of the folded margin in Ammonoids and the siphuncle in *Nautilus*. Since the animals with severed siphuncle mentioned by Willey were attached to their body-chambers by means of the shell-muscles (Willey performed the operation at the base of the body-chamber, behind the annulus) there was, of course, no danger of the animals falling away from the shells. Truncation of the septate portion is not uncommon in fossil forms, and in some *Discoceras* (probably on adaptation to a purely crawling mode of life) all the cameræ were cast off and the shell of the adult (and not till then propagating) animal consisting of the body-chamber only. This merely proves that there was no further formation of septa, and the shell-muscles became permanently attached to the shell-wall and held the animal fast, but it is not evidence against my view.

On the other hand, it could be argued that owing to its constriction at the septal necks, the siphuncle of even a truncated *Protobactrites* or of an *Amphoreopsis* (with only a few cameræ) might have been sufficient for the purpose of attachment. Only here it must be admitted that if this notching of the siphuncular tube is looked upon as a strengthening feature for such attaching purposes, then a similar function must also be assumed for Ammonoidea. In some large sections before me (*Parkinsonia dorsetensis*, *Phylloceras heterophyllum*) this constriction at the septal neck is more apparent than in the (dried) shells of the recent *Nautilus*. On the other hand, inflation of the endosiphontube (between successive endosiphon-sheaths) and of the ectosiphuncle (between the septa) is found in many fossil *Nautili* (I am not referring to the actiniform siphuncular structures), and the separation of these from the cameræ by either thick mineral deposits or by continuous septal necks does not favour an assumption of gas-secretion by the vascular siphuncle.

My opinion certainly was not based on the interesting, if unscientific, account quoted by E. A. Smith. A reference to this was given merely to show how the shell-muscles in the living *Nautilus* became detached. But the origin of the siphuncle as a constriction of the viscera, and the various structures in the multitudinous developments of the order Nautiloidea, especially the more primitive forms (*Piloceras* and the Proterozoforms of the *Cameroceras-Vaginoceras* series) seemed to me most instructive, as also the transitions from the endosiphuncular structures to the later ectosiphuncle of e.g. *Baltoceras*, which genus Hyatt placed as the first of his family Orthoceratidæ. I collected a number of very interesting Lower Ordovician Cephalopoda in Newfoundland some seven years ago, but their description is delayed because it entails a revision of the classification of the whole order Nautiloidea. I may also mention that the blackness of the outer coat of the siphuncle in *Piloceras* (the specimens are preserved in a dolomite, exactly like

the Durness fauna) and the dark outer layer of the siphuncle in certain forms of *Vaginoceras* suggested a different chemical composition, but I could not get a molybdate precipitate. My observations did not support any of the previous explanations of the function of the siphuncle, including those given by such careful observers as Professor Blake and Dr. Willey, though there was no need to go into them all again.

I may also mention that I would consider the typically regular septation of Cephalopoda as a whole and formation of chambers filled with gas (as contrasted with the tabulation, etc., in other tabular organisms) to be more or less impossible without the posteriorly attached siphuncle; also that there may be a connexion between the attachment (in Ammonoidea) to the inflated beginning of the siphuncle or cæcum (itself attached by one or more bands, the so-called prosiphon) and the progression of the end of the protoconch (in phylogeny) from asellate and latisellate to angustisellate, as opposed to the reverse tendency of the following suture-lines to deepen the external lobe. But these suggestions will be difficult of demonstration.

In conclusion, I hope that since several siphuncular structures, notably "Grandjean's membrane", still remain unexplained, Dr. Trueman will continue his investigations into the Ammonite siphuncle.

L. F. SPATH.

[This letter was received just too late for insertion in the February number.—ED. GEOLOGICAL MAGAZINE.]

THE GENOTYPE OF *SPIRIFER*.

SIR,—By some regrettable mischance certain errors of reference occur in my communication to your Magazine, January, 1920, pp. 18-20. The following corrections are required:—

p. 19, line 5 from bottom, for "M.C. ii, pl. cclxiii" read "M.C. iii, pl. cclxv".

p. 20, line 5 from top, for "M.C. ii, pl. cxxv" read "M.C. ii, pl. cclxv".

p. 20, line 8 from top, for "M.C. ii" read "M.C. iii".

p. 20, line 12 from top, for "141, 142" read "41, 42".

I may also take the opportunity to point out that Sowerby's plate of *Spirifer striatus* is numbered in M.C. iii, "170," whereas it is intended for "270". The text says "*Spirifer striatus*, Tab. cclxxi", whereas it should be "cclxx". His index corrects these errors.

I desire to thank my vigilant friend Mr. Tatcher for noting my lapses.

S. S. BUCKMAN.