researches of M. Spring and others on the physical and chemical changes produced by the action of high pressures. It seems rather rather late in the day to take this position, but the subject is too wide to be discussed here. The Belgian physicist, too, is well able to defend himself: witness his reply to the American critic cited by General McMahon.

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## COCCOSTEUS DECIPIENS.

SIR,—In a very important paper on the structure of *Coccosteus decipiens*, Ag., Dr. Traquair has recently remarked (Ann. & Mag. Nat. Hist. [6] vol. v. p. 125) that he suspects I have mistaken the lateral margin of the interlateral plate for a pectoral spine in my description of *Coccosteus*, and he feels justified in asserting that, if such a pectoral swimming organ does really exist in *C. Bickensis*, that species cannot be referred to *Coccosteus*, in which no such appendage is present.

In reply, I must repeat that there occurs a hollow, triangular, bony spine, filled with calc spar, quite distinct from the other plates. Apart from this spine, *C. Bickensis* agrees so well with undoubted species of *Coccosteus*, that I am inclined to regard Dr. Traquair's statement cited above as not yet beyond question; and although a similar pectoral organ has not yet been recognized in Scottish specimens, it is quite likely it may still be found. I am all the more confirmed in this opinion since, according to Dr. Traquair, the sclerotic ring appears to exist only in *one* specimen from Gamrie in the Edinburgh Museum, while it is rather common in my German specimens. The pectoral spine is much more rarely seen in my fossils than the sclerotic ring, and I am thus not astonished that it should hitherto have escaped observation in the Scottish examples of *Coccosteus*. Finally, I would add that the spine in *C. Bickensis* attained a length of 55mm. (fig. 12 of my paper on Placoderms), but the end is wanting, the impression of it being retained on the rock. It is therefore not shorter, but much longer than in the restoration of *Brachydeirus inflatus*.

I may add that my specimens are exposed in the Royal Geological Museum here at Göttingen, and may be examined by any one interested in the subject.

A. VON KOENEN.

GÖTTINGEN, *March 12th*, 1890.

## TIDAL ACTION.

SIR,—As tidal action has been called in of late in your pages to assist if possible in solving the riddle of the Triassic sandstones and conglomerates, it may be well to point out one line of evidence which seems to have been overlooked by the supporters of the tidal theory, *i.e. the zoological.*

Mr. Mellard Reade writes as follows in the Philosophical Magazine, vol. xxv. p. 342:—"Although it is on the littoral margins and the shallow seas opening into the oceans that the resistless force of the tides is most obvious," etc., etc.[1]

[1] See Mr. Mellard-Reade's Article in this Number, *supra*, p. 157.—ED. GEOL. MAG.

The English Channel is an excellent test case. It is shallow and opens full into the Atlantic Ocean. It lies east and west, and accordingly offers no impediment to the free play of the currents generated by the tidal wave which runs from east to west.

If unchecked tidal currents are anywhere resistless, they should be so here. Do these tidal currents disturb the gravel, or sand or even the mud on the Channel bottom? The marine fauna of the district answers this question with an emphatic negative.

It is generally admitted that very few molluscs can exist in an area of shifting sand, and the denizens of the Channel bottom are not of the number. They are, it is true, wonderfully provided with diverse defences against currents of a peculiar nature, viz. the alternating currents set up by waves; but even these must not be too violent, or the molluscs will perish by the million, as indeed they often do from this cause alone.

Geologists interested in the question of denudation and distribution by tides and waves will be familiar with Delesse's "Lithologie du Fond des Mers," and the admirable atlas accompanying that volume. If they will turn to Map 2, they will note that the area of the English Channel most frequented by shells extends from west of the Land's End to Ushant, and up the centre of the Channel to a point off Exmouth; with another large sandy area of shells west of Ushant. These are precisely the localities where we might expect the tidal currents to make a clean sweep of the Channel bottom, but nothing of the sort occurs. The presence of this Molluscan fauna in these very exposed localities is good proof that unchecked tidal currents sweeping over a fairly level sea-bottom are incapable by their own unassisted efforts of raising the sand; a glance at the map will show that they cannot even wash away the mud.

This being my special craze, and having noted observations and experiments thereon for many years, on shore and afloat, I could fortify my position at such length as would insure this letter finding a place in the editorial waste-paper basket, so I refrain.

One word in conclusion—would Mr. Mellard Reade give his reasons for believing that waves ever cause surface particles in deep water to move in "an ellipse, not very different from one having the longer axis vertical"? I have heard this stated by a lecturer, who drew a vertical ellipse on the blackboard like the long eye of a bodkin; but I have never seen the statement in print except in Mr. Mellard Reade's paper above referred to (p. 338).

Southwood, Torquay. Arthur R. Hunt, F.L.S.

## MISCELLANEOUS.

The Discovery of Coal at Shakespere's Cliff.—In February last Prof. W. Boyd Dawkins, F.R.S., announced that Coal had been reached in the experimental boring near Dover. A seam of coal of good bituminous character was reached at 1180 feet from the surface, 3 feet 6 inches in thickness, with a 4 inch parting of shale and sandstone in the middle.[1] The boring is to be continued for another 1000 feet, if necessary, to ascertain whether other beds of workable coal exist at a lower level.

[1] An oil-shale is also mentioned.