

remove a misapprehension under which, it seems to me, that he was labouring, after perusing my report, with regard to the limit to which I suggest volumetric sizing. He seems to think I advocate that the grading of the sand, which has been separated, as far as feasible, from the slimes (which are to be subsequently classified separately in four Spitz-Kästen), should be effected through very fine sieves—60-mesh screens, or under. I quite agree that to attempt to do so would fail. Such, however, is not the meaning, or, I think, the construction which can be placed on the context of my report. A glance at the diagram illustrating the sequence of the methods of reduction, clearly shows, I submit, that it is only the *coarser sands issuing from the bottom of the slime separator*, that are subjected to "volumetric sizing" in a trommel, which classifies them into three grades, the finest being through a 40-mesh sieve, which is, I apprehend, practically, the most suitable grade for the Frue-vanners to do close work; the overflow from the concentrates flowing into the Spitz-Kästen.

I trust that these observations will dispel the misapprehension which your correspondent entertained on this point at the time when he wrote his article, as I respect his opinion, and would regret to be misunderstood by him. HENRY ROSALES.

I REGRET to have misunderstood Mr. Rosales, whose report is certainly entitled to most respectful and careful consideration. My mistake (a natural one, I think) arose from a statement made on p. 13 of the report. Here Mr. Rosales says, in speaking of the Johnson's Reef Gold Mines Company, Eaglehawk, that "the battery sand should previously be classified into different grades by 'sizing' . . . Such could be accomplished by delivering it into trommels fitted with screens of different meshes. The mantel of the first trommel might be a sieve of 40 to 50 holes to the lineal inch, and the second trommel might be covered with a screen of 64 holes to the lineal inch. . . . This system of sizing would certainly be applicable." (The italics are my own.) On p. 50, where Mr. Rosales recurs to the subject of trommels, he does not mention any screen finer than 40-mesh, but, on the other hand, does not state that this is the finest that should be used, and refers to it merely in the following words:—"Supposing it [*i.e.* the trommel] to be covered with $\frac{1}{32}$ or $\frac{1}{16}$ wire gauze." Mr. Rosales' explanation will, I feel sure, be gladly received by others, besides myself, who have read his valuable report.

T. K. ROSE.

Crush-Conglomerates in Ireland.

IN your issue of March 5 there is a letter from Mr. McHenry, in which he mentions the occurrence at Portrairie and Lambay Islands, Co. Dublin, of conglomerates which he considers to be of the nature of crush-conglomerates. During the past two summers we have been examining these sections, and can corroborate Mr. McHenry's statements with regard to the presence of crush-conglomerates; but our investigations have not led us to conclusions altogether similar to his, with regard to the igneous rocks of the district. We hope to publish our results before very long.

S. H. REYNOLDS.
C. I. GARDINER.

CLAUDIUS PTOLEMY AND HIS WORKS.

CLAUDIUS PTOLEMY! What reader of the most elementary science is not familiar with his name, at least in adjectival form, in connection with the Ptolemaic system, and yet how little is known of him as a personality. That he lived in Egypt during the reigns of Hadrian and Antoninus Pius, and made astronomical observations chiefly on a terrace in Alexandria, sums up nearly the whole. But his works (addressed to Syrus, of whom also nothing is known) were the standards of authority in geography and astronomy for many centuries after his death; and though the tide of science has left them far behind, they can never be quite forgotten or cease to be of high interest in scientific history. His great astronomical work was translated into Arabic (changing its name in the process), and on the revival of learning in Europe was translated from that language into Latin, as it afterwards was from the original Greek. A French version was

published by Halma at Paris in 1813-16, but no English rendering (except of small portions) has ever appeared. The British Museum Catalogue shows that our national collection contains a large number of Greek editions and Latin translations of the Almagest (as the *Μαθηματικὴ Σύνταξις* is always called, from the Greek for "greatest," with the Arabic definite article prefixed) and Geography of Ptolemy, as well as of most of his smaller works; Halma's editions of the Greek of the Almagest and Geography, with French translation in parallel columns; and Italian translations of the latter and of the Optics. Every student of Ptolemy must be under so much obligation to Halma, that it may be of interest to state that he was born at Sédan in 1755, and after being Principal of the college of his native town, became Professor of Mathematics at the Prytanée at Paris, where he held at various times other offices, one of them being that of librarian to the Empress Josephine. Besides his version of Ptolemy and of the not very lucid Commentary of Theon (father of the ill-fated Hypatia) on part of the Almagest, he published a French translation of the Phenomena of Aratus, and died in 1828. His edition of the Almagest is preceded by an elaborate and interesting preface, and has appended to it some Notes by Delambre. Two of Ptolemy's minor works, the Planisphaerium and the De Speculis, appear to be extant only in Latin versions; the chronological table, however, of reigns up to his own time still exists in the original, whilst of the astrological work called "Tetrabiblos" or "Quadripartitum," we have not only the Greek, but Latin, French, and English translations.

The Almagest was so exhaustively examined and commented on by Delambre, that little can be added to his conclusions.¹ It is evident that Ptolemy's work is founded chiefly upon the observations of Hipparchus, which were made at Rhodes about three centuries before. Lord Macaulay's omniscient schoolboy probably believed that Ptolemy founded the system by which sun, moon, planets, and stars all moved round the earth, though the thought may have crossed his mind that this view was held before the appearance of the Alexandrian astronomer. This is, in fact, somewhat akin to the extensively-believed idea that Newton discovered the fact that external bodies are drawn or attracted to the earth. What is really due to Ptolemy as the author of the Ptolemaic system, is the reducing into a systematic form for explaining the planetary motions the ingenious imaginative machinery of epicycles and deferents. This is now so generally understood that we need not enlarge upon it here. It is almost remarkable that his discussion of the motions of the inferior planets, Mercury and Venus, did not lead him to the elaboration of the Tychonic system, something akin to which Vitruvius and Pliny seem to have had in mind, and which would in that case have held its ground for centuries; when actually started by the Danish astronomer, it was behind the age and soon stranded by the advance of science, his own contemporaries seeing that its cause was hopeless from the first. More credit is due to Ptolemy for his investigations respecting the motions of the moon, which led him to the discovery of the inequality known as the lunar evection. The inequalities he endeavoured to explain by epicycles, but for the latter he introduced in addition an eccentric, the centre of which turned about the earth in a direction contrary to that of the motion of the epicycle. A not inconsiderable portion of the Almagest is devoted to eclipses and their prediction; and we are indebted to Ptolemy for an account of three eclipses of the moon which were observed at Babylon in the years B.C. 721 and 720 under a king whom he called Mardokempados, but whose real name was Merodach-Baladan, and who, after a long contest, was completely crushed and de-

¹ A very able though shorter discussion is given in Narrien's "Historical Account of the Origin and Progress of Astronomy."