CORRESPONDENCE.

PACKING OF SAND GRAINS.

SIR,—Since the appearance of Mr. Mellard Reade's letter (p. 288), I have made some experiments, the results of which may be worth recording. The process followed was to take a specific gravity bottle of capacity 50 cubic centimètres, fill with sand, place in a balance and carefully counterpoise; then fill with water and from the increase of weight deduce the amount of water taken in. This method is sufficiently exact, and requires only one weighing, and no estimate of specific gravity. The sand was packed by continual shaking, not pressing, and it decreased in bulk very considerably during the process. Coarse brown sand was found to occupy ·7165 of the whole volume of the bottle, while fine sand filled ·7362 of the space: these results are very little short of the calculated figure for "pyramidal order," ·7405, and would doubtless be still closer if the sand were packed wet and with the aid of pressure. Against the sides of the vessel there is a necessary departure from the close order which obtains in the interior, and this disturbing element becomes, of course, more marked in proportion as the size of the grains compared with that of the vessel is larger. Thus in the same vessel fine sand packs more closely than coarse, and to obtain a similar approximation to pyramidal order in the case of shot would require a vessel of very considerable dimensions, much larger than Mr. Reade's rain-gauge measurer.

NANTLLE, *July 18th*, 1884. A. HARKER.

PROF. BONNEY, F.R.S., AND MR. J. H. COLLINS, F.G.S., ON THE SERPENTINE OF THE LIZARD DISTRICT.

SIR,—In the Quarterly Journal of the Geological Society of August 1st, Mr. Collins in his paper "On the Serpentine and Associated Rocks of Porthalla Cove," has called in question in a very decided manner the igneous origin and intrusive nature of the serpentine of that district—views held by Prof. Bonney and urged by him in several papers printed in previous issues of the same journal.

Mr. Collins contends "that the hornblende schist, Serpentine, and other rocks described are distinctly interstratified, and that there is a real passage from one to the other," that the whole "consists of stratified rocks altered *in situ* by a kind of selective metamorphism."

As an independent observer, and as one who has had many opportunities of studying the subject in the locality referred to, I feel desirous, in the cause of what is right, of confirming Professor Bonney's views as to the true igneous and intrusive character of the serpentine, of which very fortunately there is quite an abundance of evidence, and not by any means a mere matter of opinion.

From Porthalla Mr. Collins has drawn most of his arguments in favour of his views, but here there are the most convincing proofs of the intrusion of the serpentine among the hornblende slates, even more decided than any other examples I have yet seen in the Lizard district. In several of the sections here exposed the serpentine is