fication of a philosopher's misapprehension, and is meant to show not only that an organ-pipe behaves itself in a manner different to that with which it is accredited, but also why it does so; to show how important a matter in the nature of its action is this neglected difference, and how wide its bearing on the whole system of musical instruments. Here at my hand is a stopped pipe sounding mid C. I measure it interiorly from languid to stopper; it is eleven inches in length, and has a diameter of one-and-a-half inches. Here is an open pipe, same pitch, same diameter, and its length is twenty-three inches. Observe, our stopped pipe is half an inch less in length than half that of the open pipe; yet again notice, it is longer than that pipe would be if severed at the true nodal distance from the languid. How can we read eleven as precisely thirteen, and twenty-three as twenty-six inches? Under the strange notion that it is no matter if there is a difference, this has been done, and the truth of facts lost sight of or disguised in the convenient phrase, "approximately correct." The phrase assumes that there is a standard claiming nature's allegiance. We want to know, not what is correct, but what is true? Further, remark that if you stop the same open pipe at the top, the note obtained will not be an octave deeper, it will be nearly a tone sharper than that; if you stop the pipe at the centre, the note will not be the same as the open one, it will be considerably flatter; in neither case a good tone, since for its proper sounding in such condition the lip would require to be cut higher, mouth a little narrower, perhaps curved, and languid lowered. Every detail we come upon tells plainly of the working power of the reed affecting variably the results in pitch, and I think the reason for these distinctive sounding lengths will be discerned when we reach the consideration of the question of periods of vibration in pipes as tempered by rests.

The fundamental importance of the recognition that pipes of the same pitch varied between themselves as to lengths, was not perceived, nevertheless a qualifying condition was admitted that pitch was "affected by *depth* of the pipe, that is, its distance from front to back, but *width* does not affect pitch." As regards "depth," in no work within my knowledge does there exist any attempt at a solution of the problem how such a result ensues that depth interferes with pitch. It seems to be taken account of only as a disturber of the harmony of things, yet see how significant it is under the new theory of the working abstracting reed. The actual law operating admits of most precise statement when this generating power is acknowledged, viz., the difference of pitch in pipes of varied diameter (other things being equal) is proportional to the difference existing between the area of the cross-section of the pipe and the area of the mouth; the difference in pitch is greatest when the depth from front to back is greatest. It should be observed that increase of depth always flattens pitch, and tends to deprive the pipe of harmonic force. As regards the further assertion that "width" is without effect on pitch, this also is inexact and misses the very point which should have led to closer investigation. It is not true, because the same amount of wind acting over a wider area cannot do the larger extent of work with the same energy. The pitch of every pipe is affected by the width of mouth *relatively*, that is to say, its proportion to the diameter of the pipe. Apart from the ordinary rectangular and cylindrical pipes there are others of so-called "irregular shapes," which are usually viewed as monstrosities, out of the pale even of law padded with exceptions; yet these we shall find are the best evidence to us of the uniformity of the principle of action set forth in these papers, and of the consistency of a theory which recognises no exceptions.

Cylindrical pipes, notwithstanding their symmetry, differ greatly among themselves. The law by which flue-pipes differ has never yet been noticed, which is singular, since it is very striking when the pipes are thoughtfully observed, and gave the first clue to the theory of an arëo-plastic reed. A student well read in all that the best text-books in acoustics can teach, coming to the practical study of organ-pipes, and seeing in a grand organ so multitudinous an array of pipes, the unison pipes of the several stops conspicuous for diversities of diameter as well as of length, would naturally expect that here, if anywhere, he would find confirmation of Reynault's law, "The velocity of propagation of a wave of the same intensity in straight lines *is less according as the section of the tube is less.*" No! this small comfort is denied him; he is in a world of contrarieties; the law is abrogated; he will find the organ world *de facto* governed on principles the exact opposite, "*The velocity is greater as the section is less.*" Investigating further, he will find that, although in length the octaves of particular flue-stops examined are each very closely upon half the length of the other, yet their diameters do not follow a similar rule, for instead of octave or double octave being in that ratio, he must from the pitch note count to the seventeenth pipe before he will arrive at a pipe half its diameter. For other seeming anomalies, let him proceed to the stops called bassoon, trumpet, and tuba, and he will find that here increase of diameter demands not less length, but greatly increased length, to accompany increase of scale. Books of latest authorities will tell him that in an organ-pipe with a metallic reed "the note produced depends upon the length of the pipe rather than upon the length of the reed. In fact, when the note is established the reed obeys the impulses it receives from the air in the tube. Its use is accordingly rather to economise air and to give certainty and percussion to the striking of the note." Alas, it is inference by theory without test. Remove the whole of the eight or nine feet of the tube, leaving but the few inches of cup or socket, and you will have altered the pitch not more than a semitone.

All organ-pipes having metallic reeds act in conformity with Regnault's law, and the same holds good of wind instruments—trumpets, bassoons, and the like. All organ-pipes possessing air-reeds, flutes also, and some whistles, not all, display an opposite law. The musical tones of all in both these systems are the result of "suction by velocity," and the distinction is that in the former the intermittence is produced by suction under a *propulsive current*, and in the latter by suction under an *abstracting current*. The fact announces the law and leads to its explanation.

HERMANN SMITH

Faults and the Features of the Earth

MY attention has been drawn to an article in NATURE, vol. xii. p. 93, on an exploring party of the Geological Class of the University of Edinburgh to trace out a long fault in Scotland. In this it is stated that particular attention was devoted by the party to the connection between dislocations and valleys, and they came to the conclusion that not a single main valley ran along the fault they were tracing out. As an advocate of the theory *that faults or other breaks greatly induced the present features of the earth*, perhaps you may allow me to say a few words on the subject.

Fault-rock may be friable or hard; the first is inclined to induce valleys, the second peaks or ridges. Faults are of different ages, and therefore the features due to them are liable to be obliterated. Pre-Silurian features may be obliterated by the subsequent deposition of Silurian rocks, and so on upwards until we find many preglacial features obliterated by the glacial drift. In Ireland and Scotland we find more faults in the metamorphic rocks than in the overlying Silurians, in the Silurians than in the overlying Carboniferous and Old Red Sandstone, and in the Carboniferous than in the drift, while each newer accumulation obliterated, or perhaps, more properly, obscured the features in the older.

The fault examined by this party, from the brief description, seems, first, to have had a hard fault-rock, and second, its age to have been far from recent. Consequently, by the first, if the fault induced any features at all in the present surface, they ought to have been peaks or a ridge like that formed by the great Slieve-muck fault in Tipperary, Ireland; while if the second is correct, this fault ought not to form surface features, as any features due to the original fault were long since obliterated; also, the fault has been cut up and displaced by the more recent movements. If a valley chances to run along the line of an ancient fault, it probably was not induced by that fault, but by a much more recent break that for a greater or less distance coincided with the line of the older fault.

G. H. KINAHAN

Wexford, June 18

Salaries in the British Museum

AMONG your notes of last week is a favourable announcement of my promotion as an assistant in the Geological Department of the British Museum; but whilst thanking you, allow me to point out that it contains a grave misstatement as to the amount of remuneration I receive for my services (as a reference to the Parliamentary Returns will demonstrate); a misstatement alike unjust to the trustees and to myself.

May I venture to ask you to insert this, and so correct the erroneous impression which the paragraph conveys, as to the small amount of the pay received by myself and others in a similar position on the establishment.

British Museum, June 15 WM. DAVIES