Circular Rainbow

IN the notice given in NATURE (Sept. 11, p. 465) of the beautiful circular rainbow that is seen in the spray of the Montmorenci Falls near Quebec, the expression in the heading, "seen from a hill-top" will convey an erroneous idea without some explanation. The complete circle is only seen by getting down in the spray to the edge of the low rocks, within a few inches of the level of the water, and the circular bow then passes down to the feet on each side; it is indeed most perfectly seen by turning round and stooping down to look back between the legs, when the complete circle is seen without interruption from the feet. The bow is small in diameter, and is a narrow band, appearing nearer to the eye than an ordinary spray rainbow. I had the pleasure of seeing it on August 25, on the occasion of the British Association Canadian visit.

WILLIAM P. MARSHALL

15, Augustus Road, Birmingham, October 13

To Find the Cube of any Number by Construction

PROF. KARL PEARSON has kindly referred me for a *simple* graphical construction for any positive or negative power of any rational quantity whatever to Egger's "Grundzüge einer graphischen Arithmetik." This method, he informs me, is reproduced in Cremona's "Il calcolo graphico." I was of course aware that there were several simple constructions. I was induced to write upon the subject owing to the unexpected discovery that there was a line in the geometry of the triangle which enabled one to obtain the cube of a number.

October 14

R. TUCKER

EXPLORATIONS IN ICELAND¹

THE LAVA DESERT OF ÓDÁÐAHRAUN

ON July 25 we set out for the southern Dyngjufjöll, in order to examine Askja. All previous explorers of that volcanic locality have taken the northern route from Svartárkot, but no one has hitherto approached it from the east, from Herðubreið, any advance from that side having been deemed impracticable. This I wanted to test for myself, and shaped my course from the tent (pitched, as before said, to the south of Herðubreið) in a direct line on the wide gap that opens in Askja to the east. The whole intervening country was one continuous succession of lavas, so effectively covered with pumice and scoriæ from the great explosion of 1875, fortunately for us, that the whole was really one scoriac plain, the pumice boulders measuring generally one to two cubic feet, some more, some less. If it had not been for this scoriaceous cover, these lavas would have proved pretty certainly utterly impassable for horses. We took good care to keep to the crests of the thickest pumice-drifts, and though such travelling is rough enough for horses, yet they sustain no great harm, because the pumice is so light and brittle. Under the south-eastern spurs of Dyngjufjöll we came upon a lake, shallow, but of considerable magnitude, of the existence of which there was no previous knowledge. About midway between Herðubreið and Dyngjufjöll the country begins to rise up towards the aforementioned gap in Askja. Askja is a cauldron-shaped valley in the centre of Dyngjufjöll, which is an enormous complex of mountains 4500 feet high. This valley contains innumerable craters which have erupted at various periods; the sides of this valley rise to between 700 and 800 feet, but out of the aforementioned gap lavas have flowed over the lower country outside all the way down to Ódádahraun, forming an enormous oval of an average incline of 4° 33'. When we came close up to the gap, the scoriæ ceased, and at once the lava became exceedingly difficult to pass. But by aid of frozen snowdrifts filling dips and dints in the slopes, we managed to thread our way along, and thus actually to get into the valley; only one single tongue of lava we had to cross without the aid of snowdrifts—one which, though very narrow, we had the greatest difficulty in getting our ponies

over. Having at last succeeded in this, we rode along frozen snowdrifts under the southern slopes of the Askja valley, and thus reached actually on horseback the craters which exploded here in 1875. Previous visitors to Askja have entered the valley through a pass in the mountains inclosing the valley from the north, outside which pass they have had to abandon their horses and to reach the craters on foot over an almost impassable lava-stretch in the bottom of the valley, taking four to five hours in passing the distance from the pass to the craters. From our tent by Lindáa it took us nine hours to reach the craters, but the return route we accomplished in seven. We now left our ponies provided with their fodder beside the large eruptor of 1875, and set off on foot to examine the locality in every direction, spending for that purpose the whole of the bright night and a portion of the next day. So over-covered was Askja with snow that journeying along here was like journeying in the heart of winter. The whole mass of Dyngjufjöll is made up of palagonite breccia interspersed with layers of basalt. Into this mass Askja sinks in the shape of a shallow basin, and may derive its present form partly from certain stretches of it having sunk down in consequence of eruptions, partly from that natural dint or basin-formation of valleys which is so strikingly common to tufa mountains in Iceland. But the supposition that the whole of this valley, about sixteen square miles English, is one crater, the result of one great volcanic explosion, is unwarranted. In the great eruption of 1875 a very considerable extent of ground "fell in" in the south-eastern corner of the Askja valley round the craters, and the vertical precipice of the fractured crust of the earth on the side of the Askja valley measures, according to Prof. Johnstrup's survey, 740 Danish feet; that at the opposite side in the mountains is at least double in thickness. The vertical walls of the precipices exhibit in a clear manner the successive layers of lava which fill the bottom of the Askja valley. In the earth-slip thus created there was, in 1876, a small lake of dull-green colour, circular, and measuring about 4000 feet in diameter. This lake now fills the whole bottom of the slip and measures 10,000 feet in length. In 1876 the temperature of the water was 22° Celsius (71°·6 F.), but has now fallen to 14° C. (57°·2 F.). The crater, which by its explosion covered the east country with pumice and scoriæ in 1875, is situated in the north-eastern brim of the fissure, and is 300 feet in diameter and 150 feet deep; its outer circumference flat, and built up of scoriac ashes, its inside cylindric and perpendicular. In 1876 this crater only emitted steam, now it has turned into a boiling cauldron of clay, the clay mud at the bottom being gray with an admixture of bluish green tint, boiling and wallopping incessantly; through the south-eastern part of its bottom there issues by a subterranean vent a thick column of steam with loud roars and reports, and all around this column smaller fissures issue thinner jets of steam and fumes. Interspersed with the scoriæ in Askja and on the eastern side of the surrounding mountains are found small glazed grayish-blue pieces of trachyte thus formed by the last eruption: among these there are some found of which one-half, or a portion, is reduced to pumice, while the remainder retains its trachytic constituency. In the south-eastern corner of the dip right up from the water are also found a number of craters from which radiate rents and gulfs honeycombed with innumerable fumaroles and crater-tubes from which clouds of steam roll up high above the crests of the mountains, the roar and boom from which are heard to a great distance, resembling the rumbling sound of steam let off from many boilers at once. Deposits of sulphur are already visible round a number of the fumaroles, and yellow-green patches of sulphur show all about the precipices, where every chink and rupture lets off sulphurous fumes. In the eastern part of the slip the scoriaceous layers

¹ Continued from p. 565.