

the path as from  $\beta - \alpha$  Canis Minoris eastwards passing  $170^\circ \pm 0^\circ$  and disappearing behind a cloud about  $5^\circ$  beyond the latter point. The duration was  $6\frac{1}{2}$  seconds.

Comparing the two observations, I find the radiant was in Pisces at  $18^\circ + 5^\circ$ , which at the time of the meteor's appearance had an altitude of about  $4^\circ$  only in due west. The meteor was first seen from Sunderland when it was over a point near York at a height of 59 miles, and when last seen from York it was over Heligoland at a height of 49 miles. The Sunderland observer noticed the meteor a little earlier in its flight than the observer at York; while at the latter place it was retained much longer in view than at Sunderland, where a cloud appears to have obscured the terminal stages of the phenomenon. The whole length of its path was about 370 miles; Mr. Backhouse, at Sunderland, watched the meteor traverse 195 miles, so that his estimate of the duration would give 30 miles per second for the velocity. Mr. Clark saw 338 miles of the path, and his estimate of 32 seconds would give  $10\frac{1}{2}$  miles per second. The difference may be partly accounted for on the supposition that owing to the resistance of the atmosphere the meteor slackened considerably in speed during the latter part of the flight.

When last seen by Mr. Clark, the meteor was close to its anti-radiant and travelling in a nearly direct line away from the observer, so that its apparent motion would be very very slow, and the object must have looked like a hazy almost motionless star near the eastern horizon.

The radiant point at  $18^\circ + 5^\circ$  in Pisces indicates a place in the heavens where no meteor shower has ever been observed in the first quarter of the year—in fact, on March 1 it is only  $35^\circ$  east of the sun. In the summer and autumn, when the constellation Pisces is favourably presented in the dark sky, many meteor showers radiate from it and some brilliant fireballs have been directed from a similar position. The following instances may be noted:—

1884 Aug. 25	... $10 + 5\frac{1}{2}$	... Fireball	... Niessl
1858 Aug. 26	... $11 + 0$	... "	... "
1868 Sept. 5	... $14 - 2$	... "	... "
Sept 3-10	... $17 + 9$	... Meteor shower	... Schmidt
1877 Sept. 12	... $10 \pm 0$	... "	... Denning
1885 Sept. 15	... $13 + 6$	... "	... "
1875 Sept. 24	... $2 + 2$	... Fireball	... Herschel
1864 Sept. 27	... $12 - 2$	... Meteor shower	... "
1891 Sept. 30	... $14 + 7$	... Fireball	... Denning
1887 Oct. 11	... $13 + 6$	... Meteor shower	... "
1876 Oct. 19-21	... $11 + 8$	... "	... "
1872 Oct. 30	... $14 + 7$	... "	... Backhouse
Nov. 11-14	... $10 + 5$	... "	... Heis

The mean position seems to be about  $13^\circ + 5^\circ$ . It declines so far to the west in November that no showers have been seen from it afterwards, though it occasionally yields fine slow-moving fireballs. Thus in 1891 Dec. 20, 8h. 38m., I saw a meteor, equal to Venus, moving very slowly from  $124^\circ + 64^\circ$  to  $159^\circ + 49^\circ$ , and presumably from this radiant in Pisces.

Bristol, March 19. W. F. DENNING.

**Barisal Guns.**

IN regard to the "barisal guns" or "mist pouffers," lately described in NATURE, similar sounds have been heard in this region.

On July 4, 1808, the expedition of Captains Lewis and Clark was at this place. Under that date we find the following entry in their journal: "Since our arrival at the Falls we have repeatedly heard a strange noise coming from the mountains in a direction a little to the north of west. It is heard at different periods of the day and night, sometimes when the air is perfectly still and without a cloud, and consists of one stroke only, or five or six discharges in quick succession. It is loud, and resembles precisely the sound of a six pound piece of ordnance at the distance of three miles. The Minnatarees frequently mentioned this noise like thunder, which they said the mountains made, but we paid no attention to it, believing it to be some superstition or falsehood perhaps. The watermen also of the party say that the Pawnees and Recaras give the same account of a noise heard in the Black Mountains [Black Hills] to the west of them."

The mountains towards which these noises were heard were the main range of the Rockies, and distant about eighty miles. In 1854, Mr. Doty, of Governor Stevens's party, heard similar

noises. He was near enough to the mountains to be certain that the noises came from them. The locality where Mr. Doty heard them was where the direction observed by Lewis and Clark would strike the mountains.

Plenty of white men have been in this country for the last thirty years, or since 1866. I have made careful inquiry among pioneers, but cannot learn that the noises have been heard since Mr. Doty's report.

In 1810 a party, outfitted by John Jacob Astor, made an overland trip from the Missouri to the mouth of the Columbia. They tried to go through the Black Hills, but were obliged to withdraw and flank them. In these hills they note as follows: "In the most calm and serene weather, and at all times of the day or night, successive reports are now and then heard among these mountains, resembling the discharge of several pieces of artillery. Similar reports were heard by Messrs. Lewis and Clark in the Rocky Mountains.

Such explosions are also said to occur frequently in Brazil. "Vasconcellis, a Jesuit father, describes one which he heard in the Sierra, or mountain region of Peratinga, and which he compares to a park of artillery." CHAS. H. ROBINSON.

Great Falls, Montana, March 5.

**Ostwald's Energetics.**

IT may not perhaps be irrelevant to point out that even were it permissible to assert—as Prof. Fitzgerald conclusively shows that it is *not*—that because certain natural processes do not under actual conditions reverse, therefore they are irreversible, the examples of irreversibility in nature, on which Prof. Ostwald founds his "fourth attack" on the mechanical theory, are singularly ill-chosen. He directs us to the life-histories of organisms, these life-histories themselves being but a very brief portion of the indefinitely long series of transformations which the matter for that short time identified with them is going through. Yet even within this narrow range reversible actions are to be found. Surely all metabolic processes must be regarded as such. Moreover at this very moment there may quite possibly be built into our own bodily tissues, matter which some generations ago entered into the physical composition of our ancestors, has since been degraded from the rank of organic substances altogether, and is now through new-old combinations and re-combinations once more raised to its former position and forms part of a living organism. If this can come to pass, vital phenomena are clearly not irreversible. It may take much more than the lifetime of a man or of a tree for the whole cycle of operations to be complete; but when it is complete, we have as fair an example of a reversible series as we are likely to find in nature. E. M. C.

"E. M. C." calls attention to the fact that if trees do not grow into seeds they do grow seeds. This and other cases of reproduction are no doubt cases of *reproducing* the original condition, but Prof. Ostwald would rightly refuse to recognise them as cases of *reversion* to the original condition in the dynamical sense. In the case of a dynamical reversal the flow of energy is reversed. In order to have a case the reverse of the growth of a tree, it would be necessary to have a tree which radiated heat back to the sun in the reverse direction to the flow which at present takes place from the sun to the tree. Otherwise Prof. Ostwald would rightly deny that it was a genuine case of dynamical reversion. It was on account of this complication involved in Prof. Ostwald's example that I cited the very much more simple cases of irreversible thermodynamic operations, such as friction and flow of heat from hot to cold. To cite the very complex organic cases of irreversible operations instead of the simple ones, is only to cloud the question with complexity.

Prof. Boltzmann has already devoted himself to combat Prof. Ostwald's Energetics, and it would be well for those who feel any leaning towards the latter to study the views of this father of the kinetic theory of gases. GEO. FRAS. FITZGERALD.

Trinity College, Dublin, March 18.

**Classifying Crushed Ore by Trommels.**

IT was very pleasing to me to read in your valuable publication of November 7, 1895, the favourable criticism written by your correspondent, Mr. T. K. Rose, on my report on the loss of gold in the reduction of auriferous veinstone in Victoria. Nevertheless, permit me to make a few remarks to endeavour to