

Sunday's River Valleys, and on the overlying recent rocks especially, many years ago, long before the subject had attracted much attention from European Geologists, and I brought forward in a letter to Sir Charles Lyell most of the facts here given.—Yours truly,

R. N. RUBIDGE.

PORT ELIZABETH, SOUTH AFRICA.

ON THE GLACIAL CONDITION OF THE MOON'S SURFACE.

To the Editor of the GEOLOGICAL MAGAZINE.

SIR,—Allow me to send you the following results of some researches into the surface of the Moon. Viewed by the naked eye, the colour of the lunar disk is uniform, or nearly so, presenting to the spectator at night a disk or mirror of light, reddish-yellow when seen near the horizon, and in a hazy atmosphere, but of a much paler yellow, or almost white, when seen high up in the horizon under a clear atmosphere; and on a bright day, and in a blue sky, as white, or whiter, than the fleecy clouds which float past it. Seen with a telescope, the Moon loses much of its yellow appearance, which is due to our atmosphere, and has an apparent liquid electrum colour, still uniform, but revealing the mountains, with their apparent craters, and shadowy and dark patches, or non-reflecting surfaces. Neither of these visual observations are sufficient as yet to determine the nature of the surface; and, although the most powerful instruments bring it within 240 miles of the eye of the astronomer, even that distance does not seem sufficient to deprive the disk of its reflecting power, so as to enable the observer to distinguish the relative colours of which its surface is composed. Now, an inspection of the photographic and stereoscopic views of the Moon offer what I consider as a revelation of its condition, and demonstrate it to be completely Glacial. Of this I am firmly convinced, from a minute and careful examination of the lunar stereograph of Mr. H. De la Rue, and a careful comparison with a great number of Alpine photographs and stereographs in the possession of Mr. F. E. Blackstone. For not only does the former exhibit unequivocal proof of being taken from an object of which the dominant colour is white, but the surface exhibits all the peculiar transparency in textures of Snow, Ice, and Glaciers, seen in the latter. I cannot be deceived on that point, and I feel the more confident, since a great portion of my time has been spent in the examination of surfaces.

Now, although the stereoscope does not supersede the actual observation by the eye, it is a powerful aid to the determination of this question. The stereograph of Mr. De la Rue is $2\frac{1}{2}$ in. diameter, and gives 2,161 miles of the Moon's diameter, offering to the eye an optical model of the luminary about the size of a billiard ball, on which all the elevations of the mountains appear in relief. When looked at attentively, all the luminous parts of the Moon present the appearance of a Glacial country such as the wintry Alps or the Polar regions. Portions of it appear as extensive plains and ranges of elevated ground covered with snow and ice, while

others consist of elevated ranges and mountains, partly denuded, but having their summits strewn with snow and ice. Now, the reason for determining this Glacial condition is this whiteness of all the elevated portions, especially of the Polar regions, and of the peaks of the highest mountains; for if the Moon's surface were composed of plutonic rocks, such as Granites, Basalts, Traps, or covered with volcanic products, such as cinders and lavas, this state would be represented in the stereoscope by tints more or less neutral, and the Moon's surface would not present that general white appearance in the luminous portions which can only be due to reflection from an uniform surface. The photograph, in fact, were the Moon's surface composed of rocks uncovered by snow, or if it were clad by vegetation, would not come out white at all. The stereograph of Tycho is remarkably white, as much so at the base as at the summit. Now, the peak of that mountain, which lies near the lunar pole, is far above the snow line on the earth's surface; and if there existed any apparent atmosphere in the Moon, snow and ice would be naturally looked for at that elevation, and the same would be expected at the summits of our high mountains, as *Copernicus* and *Eratosthenes*, and at the lunar poles. No one, in fact, whose eye has been trained to the study of stereoscopic views of Snowy and Glacial regions could, I think, fail to recognise the presence of the same in the stereographs of Mr. De la Rue. The value of photography appears to me to be this, that it determines, within certain limits, the presence or absence of colour, and is to it what chemical tests, or the spectrum analysis, are to matter. The materials for comparison of the Moon's surface with the earth even exist. Monte Viso, one of the Alpine range, has been seen by the naked eye at a distance of 200 miles and the distinction between snow and rock clearly made out. The Bernese Oberland has been photographed by Braun, of Dornach, 60 miles off, and the elevated chain of snowy peaks not only exactly resemble in colour those of the elevated lunar mountains, but the distinction between rock and snow is clear on the stereograph, and what is more, it is possible to detect, at great distances, the difference between rock and shadow. Tycho resembles a diminished Chimborazo, and although it is not at present possible to bring Tycho nearer, it is available to remove Chimborazo optically as far off by taking stereoscopes of that and other glacial mountains with diminishing lenses so as to place them at the same relative distance, and they might then be usefully compared with the lunar ranges. I have not gone into the question of the black spots or patches about the lunar equator, which may be chasms, frozen seas, or formations not having a reflecting surface, they require to be the subject of future investigation; but not only are there glacial patches on them, but one of remarkable brilliance, with light streaming in all directions, about the centre of the Moon's equator, has a distinct crescent-shaped glacial ridge surrounding it. Nor do I here propose to enter into the reasons why the Moon is glacial, whether owing to the cooling of its internal heat or the unchecked radiation from its surface reflecting the sun's rays

like a mirror. But that this Glacial condition, is constant, and maintained by conditions unaffected by the revolution or rotation of the Moon, is evident, because no important visible change of colour takes place either at the bases or summits of the mountains or plains which lie, like our polar regions, wrapped in eternal snow. To the geologist, as an analogous condition to the Glacial period of the earth, this condition of the Moon is of the highest interest.

Some of these Glacial appearances have not escaped the notice of observers. Professor Frankland, in a lecture delivered at the Royal Institution,¹ states that, after long observations of the lunar surface, he thinks he has detected evidences of former glacial action and the presence of moraines in the Moon. In 1842, on an occasion of a lunar eclipse, Arago saw at Perpignan, on the edge of the Moon's black disk, a fiery protuberance like "an Alpine Glacier" illumined by the setting sun.

S. BIRCH.

BRITISH MUSEUM, January 19, 1866.

CARBONIFEROUS FOSSILS FOR EXCHANGE.

To the Editor of the GEOLOGICAL MAGAZINE.

SIR,—On the part of the Bolton Scientific Students' Association, who are about forming a small collection of Geological Fossils, I wish to ask your assistance in enabling our Society to exchange fossils of the Carboniferous system for characteristic fossils of other formations. By this means, collectors who have, it may be, a superabundance of fossils from their own immediate neighbourhood, but who have no facilities for obtaining Carboniferous specimens, by making a mutual exchange, will be conferring a favour, at the same time they receive a consideration in return. I shall be glad to correspond with any collector on the subject, if, by means of your MAGAZINE, we can be put in communication.—Yours respectfully,

WILLIAM WALCH, *Hon. Sec.*

29, HEATON TERRACE, ST. GEORGE'S PLACE, BOLTON, Jan. 6, 1866.

THE EARLY APPEARANCE OF MAN IN THE EAST.

We have just received (January 19th) a most interesting letter from Mr. Henry F. Blanford, F.G.S., Secretary to the Royal Asiatic Society, and of the Geological Survey of India, dated Calcutta, 22nd December, 1865, in which, after referring to the recently-published discoveries of Stone Implements in Lateritic Formations in various parts of the Madras and North Arcot Districts, by Messrs. R. Bruce Foote and William King, jun., he proceeds to say: "Poor Lieut. Irwing discovered worked agates shortly afterwards, in the alluvial deposits of the Nerbudda. Mr. Canne sent a couple of specimens to the Asiatic Society, and they turn out to be 'cores,' very small, but identical in form with that shown in Pl. I., fig. 6, of Sir J. Lubbock's work.² At the last meeting of the Asiatic Society it was announced

¹ See *Chemical News*, 1864, p. 116.

² *Pre-historic Times*, as illustrated by *Ancient Remains*, and the *Manners and Customs of Modern Savages*. By J. Lubbock, F.R.S. London: Williams and Norgate. 8vo. 1865.