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SATURDAY, DECEMBER 10, 1881.

SIR—On the evening of November 24, I noticed that the spectrum of the star DM. +36° 3987 has a bright band in the blue. The star, accordingly, belongs to the small class of objects which comprises Rayet's stars in Cygnus (near this one) and Oeltzen 17681, discovered here in 1880.

On November 25 I found a small planetary nebula, undistinguishable from a very faint star by the ordinary eye-piece, bnt detected by the character of its spectrum. Its place for 1880 is in R.A. $20^h\ 6^m\ 26^s.4$, declination $+37°\ 3'\ 25''$. It follows W. XX 200 eight seconds, three minutes of arc farther south, and is followed respectively $2^s.6$ and $2^s.3$ by two faint stars north 37″ and south 20″ of the nebula.

HARVARD COLLEGE OBSERVATORY,
CAMBRIDGE, *December* 1, 1881.

EDWARD C. PICKERING.

SHALER AND DAVIS' "GLACIERS."[1]

BY W. J. MCGEE.

I. Introduction.—The extensive superficial modification of the globe accomplished through the agency of water in its three states of aggregation has been rendered possible by certain properties peculiar to this substance, chiefly (1) its powers of assuming the several forms of solid, liquid, and vapor within the narrow range of terrestrial temperature, (2) its enormous capacity for heat, and (3) its power of dissolving other substances.

The temperature of the earth's surface is indeed largely determined by the aqueous vapor contained in the atmosphere; for if it were not for this vapor the solar energy falling upon the earth would be radiated away almost as quickly as received, and could exercise but little influence upon temperature. The narrow range of terrestrial temperature since the beginning of the organic record attests the enormous capacity and marvelous delicacy of this temperature—equalizing agent, for within the limited bounds of the space separating earth and sun, the temperature varies from a hundred thousand degrees above to two hundred and fifty degrees below the Fahrenheit zero; though accidents in this adjustment are attested by the traces of successive ice periods in the geological history of the globe. The influence of liquid water in producing the various phases assumed by the earth's surface, during geological time has long been the subject of study; but it is only within the last forty years that the newly commensurate influence of ice has been detected.

II. *The existing glaciers of the earth.*—The most accessible of the existing glaciers are those of the Swiss Alps; and the best route for the student to pursue in entering this region is to pass up the valley of the Rhone.

Here, aside from the more obscure evidence of the former great extension of the glaciers, the various works of ice-action became constantly fresher in ascending the river until they disappear beneath the wall of ice constituting the terminal portion of the glacier. At the foot of this ice wall is an irregular mass of stones and earth—the *terminal moraine*—lying across the valley, cut in twain by the muddy stream emerging from a cavern in the basal portion of the glacier; and the ice itself is gullied by tiny rills and soiled with sand and dirt, and hardened with pebbles and rock fragments, which from time to time roll down its steep front, to the morainal heap below. When the glacier shrinks for several successive seasons, as occurs when the weather is unusually dry and warm, the stream flowing from it becomes a torrent, and the moraine may be separated from the ice front by a belt of striated and polished rock, but sparsely covered with coarse *debris*; but when the ice advances for a number of years the stream dwindles, and the sheet of earth and stones is pushed forward and crumpled up into a mighty embankment, rising into a range of irregular hillocks. Many such ridges attest the various periods of temporary advance in the history of most of the secularly retreating glaciers. On ascending the ice stream itself, the superficial rock-fragments, pebbles, and earth are found to lie mainly in parallel bands, or *medial moraines*; and on tracing these to their origin, each is seen to consist of the two lines of matter constantly tumbling down the valley sides or *lateral moraines* which are brought into contact whenever two glaciers meet and merge into one. Thus the number of branches uniting to form any glacier can be determined from the number of parallel bands on its surface. The ice-stream occupies a crooked and irregular valley, the rate of its motion varying with the declivity, regularity, and width of the channel, just as does that of liquid rivers; though wherever there are considerable irregularities in the channel the strain produces cracks and fissures which gradually widen and form *crevasses*, or even, where there is a sudden increase in declivity, separates the ice into a mass of irregular pyramidal blocks, or *seracs*; but when a more uniform stretch of gentle slope is reached the seracs re-unite, and the crevasses close, transforming the fragmentary mass again into a solid,

[1] "Illustrations of the earth's surface. Glaciers; by Nathaniel Southgate Shaler, professor of Paliontology, and William Morris Davis, instructor in Geology, in Harvard University, Boston. James R. Osgood & Co., 1881." Very large 4°, pp. i—vi and 1-198, pl. i—xxv and one unnumbered, with twenty-five unnumbered leaves discriptive of plates.