

of sinking through watery strata, (6, 7, and 8) methods of supporting excavations and the construction of dams, (9, 10, and 11) methods of working, and (12) pumps and ore dressing. The illustrations have been selected with great care from standard authorities, due acknowledgment of the source being made in each case. The only fault that can be found with the diagrams is, that the authors have covered so wide a field that it has been necessary in some cases for them to crowd together into one diagram too many drawings. The best of the series are the remarkably bold and effective diagrams illustrating methods of working. The least satisfactory are the perspective views of machinery and of timbering. Plans and sections would have been better.

In Northern Spain. By Hans Gadow, M.A., Ph.D., F.R.S. Pp. xvi + 421. With map and eighty-nine illustrations. (London: Adam and Charles Black, 1897.)

THE incidents and impressions of two prolonged journeys through the northern and north-western provinces of Spain are brightly recorded in the volume before us. Personal experiences always have in them the making of an interesting book; and when things are seen with an intellectual eye, and the itinerary refers to places off the beaten track, the narrative is sure to engage attention. The present work, in which the wanderings of Dr. Gadow and his wife are described, possesses both these claims to recognition; moreover, it is well illustrated by camera and pencil. The accounts of the districts traversed, and the notes on the characteristics and customs of the inhabitants, will interest geographers; while archæologists will find a chapter on the Dolmen of Álava, and numerous short descriptions of other interesting antiquities. For students of biological science there are chapters on the fauna and flora of Northern Spain. The former chapter is a valuable analysis of the fauna of the Iberian peninsula.

LETTERS TO THE EDITOR.

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The Highest Kite Ascent.

THE general interest in scientific kite-flying leads me to send the following account of a flight here on September 19, when meteorological records were brought down from the greatest height which it is believed a kite has yet attained. The experiment was part of an investigation into the meteorological conditions of the free air now in progress here, and which is aided by a grant from the Hodgkins Fund of the Smithsonian Institution.

A Richard baro-thermo-hygro-graph (described in *La Nature*, 8 Février, 1896), weighing but 3 lbs., was hung 130 feet below two large Hargrave kites, and other kites were attached at intervals to the four miles of steel wire forming the flying-line, the total sustaining surface of the seven Hargrave kites used being something over 200 square feet. At their highest position the two topmost kites were 9386 feet above Blue Hill, or 10,016 feet above sea-level. The altitudes, at short intervals of time, were obtained from angular measurements with a theodolite, and were confirmed by the barometer record of the meteorograph.

This instrument left the ground about noon, and the greatest height was reached soon after four o'clock, the meteorograph remaining more than a mile above the hill during five hours. A little more than two hours were required for the steam-winch to reel in the four miles of wire, and the meteorograph returned to the ground at 6.40 p.m. The wind on the hill blew from the south with a velocity of about twenty-five miles an hour, but veered to the west in the upper air. The chief results, obtained from the automatic records, which are smooth and distinct, are these:—The temperature at the highest point was

38°, while at the ground at the same time it was 63°, giving a decrease of 1° per 375 feet rise, which is less than normal. The relative humidity at the ground was about 60 per cent. of saturation, but rose rapidly with height to about 4000 feet, which is the level of the cumulus clouds. It then fell, but rose again to nearly saturation above 7000 feet, when approaching the level of the alto-cumulus clouds. The humidity fell to less than 20 per cent. at the highest point reached. Throughout the flight the sky was clear.

A. LAWRENCE ROTCH.
Blue Hill Meteorological Observatory, September 23.

Outlying Clusters of the Perseids.

THE clearness of the sky, and the absence of the moon's light at the end of July and in the beginning of August last, were unusually favourable conditions here for watching the progress of the August meteor-shower of Perseids from the first signs of its appearance up to very near its date of greatest brightness. Having intended to observe the shower in connection with a watch arranged by Mr. Denning to be kept on the Perseids this year at many places, and an early beginning of the watch having been recommended, in order to note the progressive changes of the radiant-point's position, I had little expectation of being able to contribute much to this inquiry from the usual scarcity of the Perseid meteors in the shower's early stages.

A theory of its progressive motion had been formed and compared with observations by the late Dr. Kleiber, of St. Petersburg (*Monthly Notices of the Royal Astronomical Society*, vol. lii. 1891-92, p. 341), depending for its application on certain effects and laws of planetary perturbations. Starting from the same, or from a very similar principle of the effects of planetary disturbances on meteor-orbits with that used by Prof. Adams to calculate the motion of the node of the November meteor-system, that without change of shape or of inclination to the plane of the ecliptic, of the long elliptic orbits round the sun, the line of nodes or intersection of the orbit-plane with the ecliptic is carried secularly backwards or forwards slowly round the ecliptic-circle, according as the motion of the meteors in the orbit is direct or retrograde, Dr. Kleiber showed that the meteors' apparent radiant-point on the earth's encountering the stream, would also be carried with the orbit round the pole of the ecliptic at the same rate in longitude, and without any changes in its apparent latitude. If the earth should thus at any point encounter meteors of the shower which have undergone less or greater secular displacements of their nodes than the main meteor-body, so as to furnish slender meteor-streams observable a few days before or after the principal shower-date, since the earth advances round its orbit through nearly one degree of longitude each day, the differences in longitude between these slender streams' and the main stream's radiant-points will evidently be as many degrees, or very nearly as many degrees as the earth takes days to traverse the distances between the outlying meteor-systems and the main one. Tested by this criterion, Dr. Kleiber showed that of forty-nine apparent foci of the Perseids observed by Mr. Denning, in various years, between July 8 and August 16, forty-six were reducible by applying to all their longitudes the corrections corresponding according to the theory with their dates, to within a circle of only 2° radius round a point at 43°·6, +57°·1 assigned by Dr. Kleiber as the cometary radiant-point. This surprisingly close agreement certainly afforded a convincing proof of the adequacy of the perturbation theory to explain the recorded changes of position of the Perseid meteors' radiant-point; but I had been rather sceptical of obtaining from such scanty materials for observations as the very early traces of the Perseid comet meteors seem to offer, positions of sufficient accuracy to be capable of furnishing with much reliability such a very satisfactory agreement? In a watch of three hours, however, on the exceedingly fine night of July 22 last, seven Perseids were recorded here, of which two (like two on the 18th and 20th), were directed nearly from the usual shower-centre at about 43° + 57°, but the other five diverged so distinctly from about 23°, + 49° near ν and ϕ , at the point, instead of from near χ and η at the handle of the sword of Perseus, that the displacement of the radiant-point at this early date from its usual position to one in, at least, considerably lower right-ascension and declination, was at once very evident, and I was induced to longer watches, on later nights, by this first indication, than I would have thought likely, otherwise to be very usefully productive.

The following short Table (I.) gives a summary of the