the Amana meteor. This confuses the Amana meteor of February 12, 1875, with the Marengo meteor of March 27, 1894.

As was said before, the fall occurred some twenty miles west of Iowa City, and was investigated by men from the University of Iowa. Further, meteorites were shipped from Iowa City to various parts of the world. Hence the name Iowa City was attached. It does not appear in the latest catalogs directly, but in Farrington's catalog of "Meteorites of North America" one finds for the position of the fall the longitude and latitude of the University of Iowa. So the error is still with us.

The first stone recovered was found on the property of a Mr. Sherlock, and this stone, important as the only one not exposed to the elements for some months, was referred to as the Sherlock stone. Many were unable to grasp the distinction, and insisted on attaching the name to all the stones of the Amana fall. This is given as an alternate name in the latest catalogs.

When the extent of the meteoric fall became generally known, dealers sent representatives to the locality. These men made Homestead their headquarters, as that village is the most easily reached by rail of those conveniently near the fall. The dealers secured many specimens, and we find the name of their trading post, Homestead, given preference in some of the late publications. A recent book showing a map of the vicinity of the fall, and using the name Homestead, marks the position of that village but fails to show Amana and the other villages of the vicinity.

Several interesting items with no basis of fact appeared in the newspapers at the time. The prize should be awarded to a story sent out from West Liberty, forty miles east of the fall, which told of a big stone buried fifteen feet deep found near that town. This story convinced many that the University of Iowa scientists had committed a grave injustice in failing to use the name West Liberty for this meteor. At the St. Louis World's Fair of 1904, practically thirty years after the fall, the map of American meteorites showed the Amana fall as occurring at West Liberty. Even in Europe this has been given as the preferred name in museum catalogues.

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FIREBALLS AND NEW ENGLAND SCIENTISTS

THE study of the bright meteors often called fireballs, so bright that they attract wide attention and excite great interest among masses of people, differs in an important respect from that of the shooting stars of lesser brilliancy. The latter are noted for their periodicity, and for occasional showers of very numerous small meteors with some fireballs intermingled. But fireballs are generally scarce and, while there are signs of periodicity, in many cases they are certainly not members of the solar system, but appear sporadically. These two facts, and the impressive swift glare, burning train and occasional loud noises bring it about that they are for the most part observed by unskilled and unprepared observers, whose reports have to be elicited by appeals through the press and the radio broadcasting stations. The original observations are in general made without focussed attention or expectation of making any report, and the reports are made after a lapse of time from memory.

Schiaparelli plainly stated the remarkable fact of interstellar meteors, and von Niessl and his successor, Hoffmeister, have extended his work in quantity, and have shown that in some cases it is possible to group interstellar meteors as members of interstellar swarms. Continuous investigation of the facts is evidently highly desirable. This has been done in the United States by men of training and capacity from the time of Nathaniel Bowditch, and is now one of the functions of the American Meteor Society, whose president, Professor C. P. Olivier, has at intervals lately published studies of these bodies. It has, however, been plain that the whole continent is too large for one person or observatory to cover, and an attempt has been made to divide the United States and Canada into sections small enough for one institution in each. New England has been assigned to Harvard Observatory.

The object of this writing is to bring fireball observing to the attention of the readers of SCIENCE, and, in particular, to the attention of the New England members of the American Association for the Advancement of Science. The hope is that they may interest themselves in observing and reporting very bright meteors, comparable with a bright planet at least.

The Harvard Observatory has already dealt with recent fireballs, which occurred on November 15, 1925, December 29, 1925, and August 10, 1927. The first fell on a Sunday morning, the others in evening twilight. The cue for collecting the data was in each case a press notice in the morning papers the day following the fall. The means used in each case was an appeal for reports by eye-witnesses circulated in the newspapers and in the first two cases by radio broadcast also. The response was in each case rather overwhelming; there were received, in order, 140, 260, 249 reports more or less to the point. In the first case only one meteor was certainly in evidence; its position was determined in a general way as over southern Oxford County, Maine, and it was shown not to be a member of the Leonid swarm. The second case was shown not to be simple, but composite, there having

fallen within a few minutes many strikingly bright meteors in New England, New York and Pennsylvania. Seven of these could be identified with considerable certainty, and for one of them the computation of a parabolic orbit and a study of the train were possible. The last case involved the fall of about forty bright meteors within a few minutes, almost all in the New England area. Of these only four could be dealt with in sufficient detail to determine ending heights.

The characteristic quality of the reports received is for the most part incompleteness, and even in some instances vagueness. In the last case, about one hundred thirty hours were spent in acknowledging reports (by postal cards), in writing abstracts on index cards, to reduce the tedium of handling such varied stationery, and in sorting the observations into groups, each of which might reasonably be taken to represent a single meteor. When this was done, there remained forty-four reports which were too vague to be grouped, the chief reason being lack of any indication of the time of observation, and thirty-eight reports which roughly stated the time of observation, but were nearly useless because of vagueness in the statement of direction. Even among those grouped there were many uncertain.

The useful results obtained in these campaigns are in no proper relation to the population reached by the appeals, or to the time and energy applied. The investigations are too much of a *post-mortem* nature. The hope for improvement lies in two directions: one is the education of New England people to prepare them for fireball observation when fireballs come; the other is, the informing of the scientific personnel of the region as to what facts are to be noted while a fireball is in flight and immediately thereafter. By the wide-spread circulation of questionnaires whenever a fireball account appears in the papers, the population is being reached. And the scientists of New England are begged to note the following:

The important facts are, (1) duration of flight, (2) moment of apparition, (3) position of bursting or ending point, (4) apparent path. Then, the phenomena of the flight, and the moment of arrival of the detonation, if any; if there is a train left behind, its position and its changes in form.

(1) Seconds can be counted conveniently by the formula: one thousand one, one thousand two, one thousand three . . .; and the counting ought to be prolonged after the disappearance for comparison with the watch. While it is often impossible to read the second hand, this should not be omitted in the day time; then (2) follows by back reckoning. Each person has his own rate of counting.

(3) This involves close observation of landmarks and of the observer's position, on road or hillside or verandah, to be followed up by a return to the point with simple instruments. Such are the pocket compass (whose reading should be given without correction for declination) and a home-made astrolabe.[1] Better than instrumental measurements like these are exact references to position among the stars, or with relation to the moon or the sun, or to the position of the shadow of the observer's head; especially if the angles are sketched on the spot.

(4) Memory sketches of the apparent inclination are excellent. But the best record is of the apparent path and ending point among the stars. And no one should be frightened by a lack of knowledge of the constellations. In one instance a very accurate "fix" of a point on a meteor's path was given by a sketch of the path between two stars. These were marked "large star" and "small star," and stated to be "in the west." Only Vega and Altair could match the sketch at the stated time, though the New York farmer who made it probably never heard of Vega or Altair.

If fireballs would come only singly, the exact time of apparition might be of less importance for every single observer. But when they are for several minutes peppered all over several states, and several hundred people write about them, times of apparition become vital; without them the observations can hardly be sorted. Given time of apparition, the moment of arrival of the noise allows a calculation of the mean velocity of the sound and of the average temperature of the air along the sound-ray.

The changes in form of meteor trains give us almost our only information about the winds of the highest atmosphere. They should be noted and sketched carefully, and attempts should be made to photograph them. This means a wide open lens and a moderately long exposure, and careful record of the moments of opening and closing. A few photographic cross bearings on a great train would give valuable data, better than any visual work can.

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[1] This is a card (a postal card or one of that size is convenient), with a pinhole pricked through near one edge, from which hangs a plumb-line. The plumb-line is a thread, pushed through the hole and fastened on the back, long enough so that the bob—a large button, a screw nut or a pebble—swings clear of the card. One sights along the edge of the card, clips the line against the card with thumb or finger, and marks the direction of the vertical by a line on each side of the thread. The angles can be measured afterwards with a protractor. The card, without the thread, marked, with all records written on it, dated and signed, should go to the computer. There is a somewhat more elaborate form which the Harvard Observatory proposes to send out on return postal cards for use in fireball campaigns like those described above.