starboard side of the silver, some idea of the danger our nature of the undertaking may be realized. The diver reported that when he had finished there was no part of the wreck, fore and aft, standing higher than himself, excepting the engines and main boilers; it was just a heap of old iron. To Diver Angel Erostarbe was due the greatest praise for the indomitable pluck he displayed in carrying out this most difficult submarine undertaking.

The ship "Hamilla Mitchell" was lost on the Leu-

Wheel of a pulley block recovered from the "Mary Rose," sunk in the reign of Henry VIII., after being under water 295 years.

onna Rock, near Shanghai, having a heavy cargo in addition to specie valued at £50,000. Lloyd's agent was instructed by the underwriters to visit the scene of the wreck, and inform them as to the feasibility of recovering the treasure. His report was that he considered the cargo and treasure irrecoverably lost, as the depth of the water was so great and the position too dangerous for working. Capt. Lodge, however, undertook the task, and having consulted Siebe, Gorman & Co. as to the diving gear he should require, they supplied him with a set of their apparatus specially constructed for deep sea diving; and having en-

gaged two experienced divers, Messrs. R. Ridyard and W. Penk, of Liverpool, Capt. Lodge left England and duly arrived at Shanghai, where he engaged the pilot cutter "Maggie," and proceeded in search of the wreck. This operation had to be prosecuted by means of a boat, as the larger vessel could not proceed so close to the high rocks. After a search in different depths, varying from 120 feet to 160 feet of water, the divers at length found the wreck. The after part containing the treasure had rolled into deep water, 26 fathoms or thereabout, for it appears that when the "Hamilla Mitchell" struck the rock, she rested on a ledge, but subsequently gales caused her to part amidships, the after part rolling into deep water. After some difficulty Ridyard succeeded in obtaining access to the treasure room, where he found that some of the dollars were lying in heaps, the worms having eaten the wooden boxes so that they were completely riddled. Ridyard made four successful trips, the last of which proved the most advantageous of all, for on that occasion he sent up the contents of sixty-four boxes of treasure. Ridyard being thirsty, W. Penk volunteered to ascend to the top of the island to fetch him some spring water. While filling the bucket he looked round the horizon, and to his astonishment he saw an innumerable quantity of white sails coming from the mainland. He informed Capt. Lodge of the circumstances; that gentleman identified them as several hundred piratical junks bearing down upon the island. Orders were therefore given to slip the anchor and chain, but the wind being light they were obliged

to make use of oars; and, although in an exhausted condition, Ridyard pulled some time until a breeze sprang up, when they were enabled to make sail, and with the aid of night they reached Shanghai safely, running a very close risk, not only of losing the treasure they had on board, but also their lives. The Shanghai papers blame the authorities for not giving the expedition sufficient protection. The total amount of treasure recovered was £40,000, and but for this *contretemps*, Ridyard would have completed the

Carpenter's plane, found in the wreck of one of the vessels of the Spanish Armada, sunk in Vigo Bay. The difference between the handle and the position of the planing iron of this plane and of the present-day plane will be apparent.

entire salvage of the treasure. The balance was recovered some time later.

These three operations are particularly notable by reason of the great depths from which the specie was recovered, but much larger sums in specie, etc., have been recovered from vessels sunk in shallower depths, as, for instance, in the cases of the "Malabar," from which bullion to the value of £300,000 was salvaged; the "Darling Downs," cargo of wool, etc., valued at £100,000 (of 725 bales all but five were recovered by divers); steamship "Queen Elizabeth," cargo and specie valued at £120,000.

MARS DURING THE RECENT OPPOSITION.

AN UNEVENTFUL ASTRONOMICAL EVENT.

BY W. E. ROLSTON.

SO FAR as can be judged from those yet published, the results accruing from the observations of Mars made during the opposition of 1909 are, says Nature, in a sense, disappointing. The favorable conditions of the opposition, as regards the altitude and the apparent diameter of the planet, engendered the hope, in many minds, that most of the outstanding problems in the Martian enigma would be solved more or less definitely. Yet the camps into which aerographers are divided are still at issue, and the differences appear to be at least as sharply accentuated as before. To the one side the *canali* are still continuous channels, set out with a rectitude more or less geometrical, and having "oases" around the reservoirs upon which they appear to converge; but to the opposition these clearly cut channels are but alignments of dark spots merged into apparent continuity by a physiological illusion.

However, many of the larger features are beyond dispute, and many valuable observations of their appearances and changes have been made since July last. One very remarkable phenomenon was noted, and has been discussed by practically every observer, viz., the apparent veiling of the planet's surface during the earlier part of the opposition.

In June, July, and August the details, and even some of the larger features, were not discernible; there was a general lack of contrast between the light and the dark areas. Thus M. Antoniadi, using the 24-centimeter (9.45-inch) refractor at Juvisy, reported (Bull. de la Soc. astron. de France, September, 1909, p. 386) that, on August 11th and 12th, the surface of Mars was hardly recognizable, and it was with great difficulty that he assured himself that it was the region of the Mer de Sablier on which he was looking. M. Jarry Desloges also emphasized the unusual appearance of the planet, which he illustrated (Comptes Rendus, vol. cxlix., No. 17, p. 666) by two charts, on one of which M. Fournier had recorded the features seen during June, July, and part of August, while the other showed the increased contrast of the same features later in August and during September.

It was not until the beginning of the last month that the accustomed contrasts and details completely reasserted themselves and permitted the work of confirmation and discovery to proceed normally.

M. Antoniadi suggests that this masking effect was caused by the interposition of light, cirrus cloud in the planet's atmosphere, such cloud being filmy in structure and yellowish in color, so that it reduced the usual contrasts without totally obscuring the features. This is in accordance with Prof. W. H. Pickering's observations in 1895, when he found that his photographs suggested some such yellow screen.

The importance of the acknowledged existence of clouds must not be lost sight of in the discussion as to the aqueous contents of the planetary atmosphere.

The observations of Beer and Mädler, Secchi, Lockyer, Denning, and others, of apparent changes caused by clouds have been generally accepted as strong evidence for the existence of the cloud-producing compound of our own atmosphere.

Turning now to the actual observations of features, and their modifications, during the recent opposition, we find that the diminution and transfiguration of the southern polar cap was recognized quite early in the season.

M. Jarry Desloges, observing with a 29-centimeter (11.41-inch) refractor at Masegros (Lozère), recorded (Astronomische Nachrichten, No. 4340) a dark cutting in longitude 190 deg. on June 20th-23rd, and at the Revard station Lowell's crevasse in longitude 350 deg. was easily seen, cutting right through the cap. A large and brilliant spot near the edge of the cap, in longitude 30 deg., was also seen on July 4th. The progressive diminution in size and the changes in the southern polar cap of Mars, were observed by M. G. Fournier at the Revard Observatory, and M. Desloges (Comptes Rendus, No. 26, vol. cxlix., p. 1347), remarks on the increased rate of diminution about August 15th, and suggests that the variations in detail and the time of disappearance are probably indications of inequalities in the relief of the polar areas.

M. R. Jonckheere, observing with a 14-inch refractor at the Hem Observatory (Roubaix), also directs attention to this feature. On August 12th he observed (Astronomische Nachrichten, No. 4354, p. 159) a "land" become detached from the cap, although itself still covered with ice, and identified it as Schiaparelli's Novissima Thyle. On these grounds he suggests (Comptes Rendus, No. 22, vol. cxlix., p. 970) that the "lands" remain covered with ice much longer than do the "seas," thus producing apparently irregular variations in the measured diameters of the cap; when, by the planet's rotation, such an ice-covered "land" is brought to the extremity of the apparent ellipse, the major axis will appear to be longer than when the "land" is carried further round. M. Jonckheere's measures of the cap show the following progression: July 16th, 32 deg. (Martian arc); August 15th, 18 deg.; September 17th, 9.3 deg.; October 18th, 11.8 deg.; November 18th, 10.2 deg. On September 2nd, Argyre II. was seen, and its position determined as longitude 60 deg., latitude -80 deg.; this is nearer the pole than it has hitherto been placed, and M. Jonckheere deduces, generally, that the latitudes ascribed to the polar lands are usually too small. Another mass was seen, on the same evening, in longitude 120 deg., latitude -84 deg., which apparently had not been recorded before, and to this M. Jonckheere gives the name "Stella," on account of its brightness. "Thaumas" is the name given to another new land which suddenly appeared in the Aonius Sinus, touching Thaumasia, longitude 100 deg., latitude -43 deg.

According to Prof. Lowell (Astronomische Nachrichten, No. 4371, p. 47), the first snowfall of the season in the Martian antarctic region took place on November 17th—about two months after the summer solstice—when two patches in latitude -65 deg. were seen in longitudes 100 deg. and 190 deg.

M. Antoniadi also made observations, at the invitation of M. Deslandres, with the 33-inch refractor of the Meudon Observatory, the third largest refractor in general use. He observed on thirty nights between September 20th and November 9th, but on about five nights only were the atmospheric conditions really good. The most noticeable change since 1907 was in the Syrtis Major, which he found had returned to its form of 1864 and 1877. The Lac Mæris, too, had reappeared as a large, indefinite dark patch, and a multiple island was seen in the eastern part of the Mare Cimmerium.

The Solis Lacus region also presented many striking features, and, among others, M. J. Comas Sola devoted special attention to it (Bull. de la Soc. astron. de France, November, 1909, p. 497). In his opinion, the recent opposition "peut être considérée comme la dérouté définitive du réseau géométrique des canaux."

It is in regard to these all-important "canali" that the battle of observers rages most intensely. Among European observers, at least, there appears to be consensus of opinion that the term should be used in a more restricted sense, or should only be employed as a generic term embracing several species. There is too great a diversity between the broad, persistent, half-tone patches and the narrow, evanescent streaks, glimpsed for one fraction of a second to be lost the next, for them all to be grouped under the one designation. M. Antoniadi strongly insists on this point (Comptes Rendus, vol. cxlix., No. 20, p. 836), and classifies eight varieties. Even then he does not include the fugitive right lines, visible only for the fraction of a second, which he considers may be illusions; but he very definitely negatives the existence of any geometrical *réseaux*, of which he finds no trace. At intervals of exceptionally good seeing he sees considerable structure, visible for several consecutive seconds, on the continental areas, and this he describes as "a gray irregular marbling, complex and cloudy, such as only an artist could render."

The Rev. T. E. R. Phillips, observing at Ashted with his 12-inch Calver reflector, was led to substantially the same conclusions (the Observatory, No. 416, p. 463) as M. Antoniadi regarding the canals.

The necessity for the classification of these features is also advanced by M. Desloges, who suggests (Comptes Rendus, vol. cxlix., No. 17, p. 664) three species, and also directs attention to numerous changes observed during this opposition. The fine *canaux* of his third class were apparently the most affected by the seasonal changes, and M. Desloges finds it difficult to disbelieve their objective existence; one

argument advanced in its favor is that they all appear to start in small gulfs, just as the broad, indubitable, dark bands, of the first and second classes, generally have their origins in the larger gulfs.

An encouraging feature of the opposition, which in future developments may lead to a settlement of this vexed question of "objective" and "subjective" phenomena, is the advance made by photography in the recording of the planet's markings. On Prof. Hale's striking photographs (Monthly Notices, vol. lxx., No. 2, p. 175) the contrast between the dark and light areas is remarkable, the bolder features standing out with a distinctness usually seen only on carefully prepared drawings.

Results of great interests were also obtained by MM. de la Baume Pulvinel and Baldet (Comptes Rendus, vol. cxlix., No. 20, p. 838) at the Pic du Midi Observatory, where the conditions are especially favorable for such observations. The observers intend to make a detailed study of the 1,350 images recorded on their set of eighty plates, but, from a brief survey, they are able to state that anyone conversant with Martian topography would immediately recognize nearly all the features observed visually. The canals of the first order, the broader bands such as the Indus, the Ganges, Araxes, Cyclops, Euphrates, etc., are all recognizable, but there is no trace of the geometrical network of fine canals recorded visually by many observers.

While in London recently, Prof. Lowell pointed out that while many of the recent photographs form striking pictures by reason of their strong contrasts in the large areas, the treatment which brings out these contrasts is not that calculated to show also the finer details.

Thus the evidence for the actual existence of the canaliform "canals" is still "mixed." A number of experienced, careful observers still proclaim, with no lack of decision, that they exist; others just as emphatically state that they are, at the most, but the physiological integration of the elements of a mosaic groundwork which covers the planet. Prof. Frost states that the 40-inch refractor at Yerkes is "too powerful" to show them, and Prof. Hale refers to Prof. Barnard's description of 1894 (Monthly Notices, vol. lvi., No. 4, p. 166, 1896) as describing exactly what he sees with the 60-inch reflector at Mount Wilson.

This question of aperture is not a simple one. Thus Prof. Lowell has repeatedly stated that a large aperture is not infrequently a positive barrier to the seeing of such fine details as occur on planetary disks. Attached to his 24-inch refractor he has a system of diaphragms, and the first operation in making an observation is to determine what aperture is most suitable for the conditions obtaining at the moment. A similar procedure was followed by Dawes, whose observations in the sixties of last century did so much to forward aerography. When discussing the work with Sir Norman Lockyer—who also, at that time, was making valuable drawings of Mars—Dawes repeatedly referred to the conditions of seeing as "a 5-inch night" or "a 6-inch night," etc. Asked for an explanation, he stated that he often found it necessary to reduce his aperture, which normally was 8 inches.

We also learn from Sir Norman that when his drawings were discussed at the Royal Astronomical Society, some doubt was expressed because some of the details shown thereon were not shown on the drawings made at the same epoch by the observer using Lord Rosse's reflector; yet when the Leyden

drawings arrived, later, these details were confirmed.

Thus Prof. Frost's somewhat enigmatical statement may, logically, be understood to convey a meaning other than that which has generally been ascribed to it, and the failure of the 60-inch reflector to show the straight, hard, sharp lines may not be conclusive evidence of their non-existence.

So far, the employment of the photographic plate has not provided the hoped-for solution of this special question, because the exposures necessary are too long. Each image on the plate is an integration, the moments of fine seeing are overlaid by periods of tremor, and, by their very nature, fine lines would be the first to disappear; it is a case where negative evidence is of little value. Nor does it seem logical to say that these lines do not exist because their appearance can be explained otherwise—physiologically, for instance. Their recognition in the same positions by independent observers, at different times, points to the existence of some material objects, and their changes with the change of season exclude the proposition that they are completely solid markings. Even the suggestion that they are alignments of darker spots does not prove that they are disconnected items. In desert areas the streams dry up, leaving "water holes"—apparently disconnected if viewed from a great distance—and these holes are surrounded by vegetation throughout the dry season, becoming, therefore, isolated objects; but the river bed is there, and in due season—as on Mars—is filled with water and edged by vegetation.

But their great size, their prolific distribution, and their rectilinear character, even when seen away from the planet's central meridian, are phenomena which are difficult to explain in the case of the Martian canals; and the problem yet remains.

A suggestion made by Dr. Aitken, of the Lick Observatory, might possibly solve this vexed question to some extent. Prof. Lowell's unanswerable argument is that, as the "canals" are so near the limit of vision, it is only in the very finest atmosphere that they can be seen. All observers agree as to the first part of this statement, and Dr. Aitken suggests that the second part might be put to the test by arranging that such experienced protagonists as Prof. W. H. Pickering, M. Antoniadi, and Prof. Barnard should foregather at the Flagstaff Observatory and, with Prof. Lowell, observe Mars during the next favorable opposition. The 24-inch refractor is, as Prof. Lowell has demonstrated, a superb instrument, and for astronomical observations of this character the Arizona atmospheric conditions are unexcelled. The suggestion is a most excellent one, and, could the arrangements be made, the meeting would no doubt lead to an illumination of what, at present, is a very obscure problem.

There are some problems in astronomy which seem to be indeterminate. First, we get a positive solution in one direction, and then appears the amendment, which is a direct negative; as an example one might cite the rotation periods of the inner planets; but one that is nearer to the present question is the problem as to the spectroscopic evidence for the existence of water vapor in Mars.

Since Huggins compared the Martian and the lunar spectra in 1867, a number of observers have made similar observations under various conditions, and with contradictory results. The summarized history of the research is given by Prof. Campbell in a recent bulletin (No. 169) from the Lick Observatory, and the majority of the conclusions are in favor of the presence of water-vapor bands; whether the conclusions

were supported by the evidence, when adequately analyzed, is the question. Observations made at Mount Hamilton in 1894 demonstrated to him that, to obtain satisfactory evidence, they should be repeated at an altitude sufficient to escape the greatest possible proportion of the terrestrial atmospheric effects, and, to this end, he examined the conditions obtaining on the summit of Mount Whitney, the highest point in the United States, in 1908. The preliminary survey satisfied Prof. Campbell as to the atmospheric conditions, and he decided that, if the necessary money could be obtained for shelters and equipment, an expedition from the Lick Observatory should take advantage of the favorable opposition of 1909 to carry the research a step further. As is usual in, and, one might say, peculiar to, America, funds were forthcoming, with the result that, at the end of August, 1909, the summit of the mountain was occupied by an expedition ready to take spectrograms when the conditions of Mars and the moon were favorable.

Such spectrograms, six in number, were secured on the nights of September 1st and 2nd, and it is to the discussion of the evidence afforded by these that Bulletin No. 169 is devoted. This evidence does not appear to be positively conclusive, but Prof. Campbell deduces "that the quantity of any water vapor existing in the equatorial atmosphere of Mars at the time these observations were made was too slight to be detected by present spectrographic methods. . . . it is difficult to conceive that the quantity of vapor above unit area on Mars could exceed or equal the quantity of terrestrial vapor above the same area of Mount Whitney."

It should be remarked here that the altitude of the summit of Mount Whitney is 14,501 feet, and, according to Hann's empirical formula, 0.79 of the terrestrial water vapor would be below.

Prof. Campbell expressly states that it is not contended that Mars has no water vapor, and that polar caps composed of hoar-frost, demanding a small quantity of vapor, would probably not be out of harmony with his observations. In Bulletin No. 43 of the Lowell Observatory Mr. Abbot's report is quoted to the effect that he and Prof. Campbell were on Mount Whitney during unusually unfavorable weather, under conditions which would probably not be met with at that season one year in ten. This is important, because, no matter how much of the theoretical water-vapor content of the terrestrial atmosphere was left below, it is absolute evidence that water vapor was present, in quantity, above.

The Mount Whitney plates, at the most, only afford negative evidence, and it is not contended that they do more. Thus the question of water vapor becomes one of amount rather than of existence or non-existence, and its settlement is rather academic than practical. There is no doubt as to the difficulty of securing absolute evidence—so many variables have to be eliminated before the sought-for residual is attained.

But, as stated above, the question is now generally accepted as settled in favor of the presence of water vapor in the Martian atmosphere. The darker edge of the melting "snow" caps, the proved existence of clouds, and the changes of intensity and shape of many features, point definitely to the existence of a fluid material, and, without any violent assumptions, to that fluid being water. We note that Prof. Campbell suggests that the observed yellowish color of the clouds may indicate for them some other chemical compound than H₂O, but, if this is so, should not the spectrum of Mars indicate some other absorption which is not mentioned?—Nature.

FIELD WORK IN BOTANY.

PROF. J. W. H. TRAIL, before the British Association for the Advancement of Science, spoke of work in the field, and said: "There are few paths more likely to prove attractive to most students. The study of the plants in their natural environments will lead to an understanding of their nature as living beings, of their relations to one another, and to other environments of the stimuli to which they respond, and of the struggle for existence that results in the survival of certain forms and the disappearance of others: In this way also will be gained a conception of the true meaning and place of classification as an indispensable instrument for accurate determination and record, and not as an end in itself. To one that has once gained a true insight into the pleasure and worth of such studies, collections made for the sake of mere possession or lists of species discovered in a locality will not suffice. Many questions will arise which will prove a constant source of new interest. From such studies a deep and growing love for botany has in not a few cases arisen." He urged the necessity of a complete survey of British botany. Much excellent work had already been accomplished and put on record toward the investigation of the flora, but much of that store of information was in danger of being overlooked and forgotten or lost owing to the absence of means to direct attention to where it might be found. A care-

ful revision of what had been done, and a systematic subject-index to its stores were urgently required. The systematic works treating of the flora were in great part not fully representative of the knowledge already possessed, and required to be brought up to date, or to be replaced by others. Great difficulty was caused by the absence of an authoritative synonymic list that would show as far as possible the equivalence of the names employed in the various manuals and lists. There was much reason to wish that uniformity in the use of names of species and varieties should be arrived at, and a representative committee might assist to that end; but, in the meantime, a good synonymic list would be a most helpful step toward relieving a very pressing obstacle to progress. There was need for a careful analysis of the flora with a view to determining those species that owed their presence here to man's aid, intentional or unconscious. The topographic distribution, though so much had been done in that field during the past sixty or seventy years, still required careful investigation. A careful study of the flora was also required from the standpoint of structure and development. While "English Botany" in its first edition was deservedly regarded as a work of the first rank among floras, it had long been defective as representing our present knowledge of British plants, and it had not been succeeded by any work of nearly equal rank, while other countries

now had their great floras of a type in advance of it. There was need for a great work worthy of our country, amply illustrated so as to show not only the habit of the species and varieties, but also the distinctive characters and the more important biological features of each. Such a flora would probably require to be in the form of monographs by specialists, issued as each could be prepared, but as part of a well-planned whole. It should give for each plant far more than was contained in even the best of our existing British floras. He believed that a well-organized botanical survey of the British Islands would give results of great scientific value, and that there was need for it. He believed, also, that means existed to permit of its being carried through. There was no ground to expect that it would be undertaken on the same terms as the Geological Survey. A biological survey must be accomplished by voluntary effort, with possibly some help toward meeting necessary expenses of equipment from funds which were available for assistance in scientific research. Was such a survey not an object fully in accord with the objects for which the British Association existed? In the belief that it was so he asked the Section to consider whether such a survey should not be undertaken; and, if it approved the proposal, he further asked that a committee be appointed to report on what steps should be taken toward organizing such a survey.