

Then follows a very lucid and interesting historical survey of the chemistry of synthetic indigo. Attention is called to the fact that the first patent bears the date of March 19, 1880, and that although we knew that artificial indigo prepared by this, the cinnamic acid synthesis, could not compete with the natural product, yet its appearance caused much consternation among indigo planters. But because the threatened storm did not break, the planters evidently quickly forgot their fright and returned complacently to their old rule-of-thumb methods. Not so the chemists; they steadily and perseveringly plodded on, and in 1882 von Baeyer and Drewson brought out another synthesis, viz. the condensation of acetone and orthonitrobenzaldehyde in presence of caustic alkali. This process, or a modification of it, is employed at the present by the firm of Messrs. Meister, Lucius and Brunning; but as the supply of the raw material—toluene—is limited, Prof. Meldola, speaking as an individual, says: "Were I a planter, I should have no anxiety whatever with respect to a competing product which starts from toluene." Every 1000 gallons of coal tar yields about $6\frac{3}{4}$ gallons of benzene and $3\frac{1}{4}$ gallons of toluene, therefore any process which started with benzene as the out-going product should be better able to compete than one in which toluene is the starting material. However, although there are several syntheses which start from aniline (produced from benzene), the methods employed are so costly that at present the planter has very little to fear in this direction.

Naturally the chief portion of the paper is devoted to Heumann's synthesis, as at present worked by the Badische Company. This process, which starts from naphthalene, the supplies of which are practically unlimited, was described in NATURE, November 29.

In his references to the Badische Company Prof. Meldola quoted the following facts from the official report prepared for the Paris Exhibition:—

"The factory at Ludwigshafen employs 148 scientific chemists, 75 engineers and technical experts, and 305 members of the mercantile staff. In 1865 they commenced with 30 workmen, and they now employ over 6000. The consumption of coal is about 243,000 tons per annum; water is supplied to the factory to the extent of some 20,000,000 cubic metres annually; they make 12,000,000 kilogrammes of ice, and over 12,000,000 cubic metres of coal gas in the course of the year. The electric installation consists of eight dynamos, the currents from which serve for illumination, motive power and electrolytic processes. Steam is supplied from 102 boilers, which serves for heating purposes and for driving 253 steam engines."

Let the British manufacturer and the Indian indigo planter try to digest these hard facts and figures. I wonder whether there are 148 scientific chemists employed by manufacturers in the whole of the United Kingdom. Let them also remember that these figures only refer to one firm.

Finally, Prof. Meldola refers to the natural product *versus* synthetical indigo. He is unable to hold out the hope that the natural article will in the long run be able to compete with the product of the German factory. "The planters have allowed twenty years of activity on the part of the chemists to pass by with apathy and indifference, and at the last moment only have they called in expert assistance."

It is truly marvellous that only the British planter should have been so lethargic. In Java the Dutch planters "have had the wisdom to avail themselves of the resources of the botanical gardens for experimental purposes, and their chemists and bacteriologists working in Holland in co-operation with the planters have, as is well known, for many years past been contributing to chemical literature the results of their investigations."

Reference is made to the contradictory opinions as to

what goes on in the steeping vats, as to whether the resolution of the glucoside indican into indigotin is due to bacterial fermentation, or whether it is one of ordinary zymolysis. Attention is also directed to the drying process, which often extends over several weeks, and during which time it is stated that a fungus grows on the cakes and ammonia is evolved. Prof. Meldola asks whether this may not be due to the destruction of indigo by a micro-organism. I have myself often wondered that in all the suggestions for improving the yield and quality of indigo no one appears to have drawn attention to this apparent decomposition. It seems possible that more thorough washing and rapid drying in a current of hot air would perhaps prevent this. In his closing remarks Prof. Meldola refers to the antiquity of the industry, and questions whether the methods at present employed in India are very different to those used in the time of the Pharaohs.

F. MOLLWO PERKIN.

THE OLDER CIVILISATION OF GREECE.¹

THE sixth volume of the *Annual of the British School at Athens* contains matter of extraordinary interest to students of the history, not only of Greece, of Egypt and Western Asia, but also of mankind in general. The culture which now dominates the world is the child of the civilisation of Ancient Greece, and any archaeological discovery which tends to increase our knowledge of the beginnings of Greek civilisation possesses an importance and an interest far greater than that of any other possible discovery whatever in the archaeological field.

For the last twenty years, since Schliemann first unveiled the treasures of the citadel of Mycenæ, it has been recognised that the culture of classical Greece as we know it is but the second epoch of Greek civilisation. Classical Greece had a past the true history of which had been half forgotten, had been preserved in confused and contradictory legends. The culture of the past had bloomed from end to end of the Greek world, in cities, some like Athens or Knôssos, of renown in classical as well as præ-classical days, others like Mycenæ and Tiryns, cities whose fame ceased to be when the Dorians entered Greece. This culture was bronze-using, and was, in fact, the Greek phase of the European culture of the Bronze Age, a phase earlier in date than the phases of Central and Northern Europe, and in all probability not only their forerunner, but to a great extent their forbear. This culture itself developed out of a stage of transition from Neolithic barbarism, which we call "præ-Mycenæan," during which stone, copper, and occasionally bronze, were used side by side, pottery was rude and unpainted, and the dead were buried in *cist-graves*. This stage shades off on the one side (as in the first city of Troy) into the Neolithic culture, on the other (as in Cyprus) into Mycenæan civilisation, which marks the first stage of real "civilisation," properly so-called, in Europe. The earliest stages of the Mycenæan culture are known to us from discoveries of settlements with pottery, &c., in Thêra, at Phylakopê in Melos, at Kamárais in Crete, and other isolated spots, chiefly in the Southern Ægean islands. The civilisation which we find at Mycenæ, at Vaphio, at Ialysos and elsewhere, is the same as that of Phylakopê and Kamárais, but is more highly developed in many ways. This can only be the culture of the heroic Achæans, which was overthrown by the Dorians; its date must, then, be placed certainly before 900 B.C., even if, as is very possible, it continued to exist in Western Asia Minor and Cyprus till the eighth century. We can be more certain about its date than this; Mycenæan culture was by no means confined to

¹ *The Annual of the British School at Athens*; No. VI. Session 1899-1900. Pp. viii + 156. With illustrations and two maps. Printed for the subscribers and sold on their behalf by Macmillan and Co., Ltd. Price 10s. 6d.

Greece, and there were ships and sailors in those days as bold and venturesome as any of the time of Elizabeth. We know from the Egyptian State archives of the reign of King Akhunaten (B.C. 1430; date determined by synchronism with Burraburiyash of Babylonia, B.C. 1430) that in the XVth century B.C. the Phœnician cities already traded with many lands across the seas, with Egyptian Thebes, with Alashiya or Cyprus (?), and with *Keftiu*. The people of *Keftiu* came to the court of King Thothmes III. of Egypt (B.C. 1550) with gifts.

Where was *Keftiu*? Mr. A. J. Evans tells us this in this sixth volume of the *Annual of the British School at Athens*.

Mr. Evans's excavations at Kephala, the site of Knôssos, in Crete, are the culmination of many attempts, pursued during several years past under difficulties of all kinds, to elucidate the early history of Greek civilisation in Crete. The traditions of the island point to its having occupied a position of especial prominence in the Mycenaean world, and Mr. Evans's hopes of great results from Cretan exploration have not been disappointed. He has not only discovered at Knôssos a Mycenaean palace of the first

"Kamárais-period," continued to be occupied down to the period of its sudden sack and destruction by fire towards the end of the Mycenaean age, at which time only vessels of the later type were in use, while in the town we have two strata of settlement, the one containing the vases of the earlier period, the other those of the later generations of inhabitants. There need be no question of a change of race here, though Mr. Hogarth seems to suggest it. Alteration of style in art is no proof of racial change. Such changes are simply due to an alteration of fashion, suddenly started by some artist. We have an example of a sudden alteration of the kind in Egypt in the early years of the XVIIIth Dynasty. But we do not therefore in this case assume the violent substitution of one race of inhabitants by another. Even alteration of burial customs is no clear proof of change of race.

Important as the relics of the "Kamárais-period" from the Knôssian town are, however, they pale before the importance of the discoveries made in the palace itself. The excavation of this, probably the most important Mycenaean building yet discovered, is only begun, and we know not how Mr. Evans may increase our knowledge



FIG. 1.—Protomycenaean Vases from Knôssos: probable date before 1600 B.C.

rank, which is very probably identical with the legendary "Labyrinth" of Minôs, but has also discovered that the Mycenaean of Crete were in all probability the same people as the "Men of *Keftiu* and of the Isles in the midst of the Very Green" (*i.e.* the Mediterranean), who make their appearance in Egyptian history *c.* 1550 B.C., thus giving the earliest trustworthy date for the Mycenaean civilisation.

Not only the palace, but also the Mycenaean town of Knôssos was discovered in the course of these excavations. The exploration of the town ruins was carried on by Mr. D. G. Hogarth, late Director of the British School at Athens, Mr. Evans busying himself more especially with the exploration of the palace. It is noteworthy that vases and fragments of vases found in the town ruins were of the early Mycenaean or "Kamárais" type, while those found in the palace mostly belonged to the fully-developed Mycenaean types so well known to students of early Greek art from the great work of Messrs. Furtwängler and Löschcke. This does not necessarily mean that the town-ruins are all older than the palace; all that is implied is that the palace, which from various indications was evidently already in existence in the

of the older civilisation of Greece in the course of his diggings this year. What he found last year, however, gives us material enough to think about! The plan of the palace shows a vast labyrinth of chambers, halls, corridors and passages; a true labyrinth indeed, for it is the only genuine and original Labyrinth itself, as the constantly-recurring symbol of the double-axe, the emblem of the later Zeus of *Δαβραν-νδα*, which is etymologically the same word as *Δαβύρι-νθος*, "The Place of the *Δάβρυς* or Double-Axe" (for the earliest Mycenaean of Knôssos and elsewhere were not Aryan Hellenes, but "Pelagians" allied to the non-Aryan peoples of Asia Minor), the emblem of the Knôssian Zeus, *Zeús áναξ, Πελαργικός*, shows. This is the labyrinth of Minôs: is the bull-headed Minotaur, child of Zeus, of whom legends passed to the succeeding Hellenic inhabitants of the land, the recollection of some Mycenaean deity to whom human sacrifice was offered at Knôssos? We know the love of the Mycenaean for bulls, we see the *protomae* of bulls at Mycenæ and among the gifts of the *Keftiu*, we find pictures of *ταυροκαθάψια*, bull-catching, at Tiryns and elsewhere, we have the splendid life-sized relief of a bull's head in painted *gesso duro* from Knôssos itself (Fig. 10

of the work under review); there are hundreds of other instances. The bull was the beast of Zeus: the idea of a Phœnician origin of the Minotaur is just so much rubbish; he is a purely Mycænæan conception. And his master, Minôs? What would Mr. Grote have said had he been told that in 1901 the name of Minôs would pass

fast gaining ground, that Egypt exercised no little influence upon the development of Mycænæan culture. On the other hand, the use of clay for the tablets is a sure sign of the influence of the rival civilisation of Babylonia. Many of the tablets evidently contain simply lists of ships, chariots, horses, swine, &c.; so much we

can guess from the pictures. The numerical system is evident; further than this we cannot go. It had long seemed curious that the highly-developed civilisation of Mycænæan days should have been ignorant of the art of writing; but we had no conclusive proof of Mycænæan writing before Mr. Evans's epoch-making discovery. Now here are the records of the Mycænæans before our eyes; *σηματα λυγρά*, indeed! They will not wait for energetic "Bearbeitung," and the Clarendon Press is already preparing a fount of Mycænæan type! But the omens are bad.

We have remarked that Mr. Evans has shown that the *Keftiu* who brought gifts to the court of Thothmes III. of Egypt, *c.* 1550 B.C., were Mycænæan Cretans. This conclusion is a legitimate one. Some of the finest known examples of Mycænæan fresco-painting have been found in

the Knössian palace, and among them are representations of processions of men bearing vases, &c., who in dress are absolutely identical, on the one hand, with the bull-catchers of the Vaphio cups, on the other with the *Keftiu* who are depicted on the walls of Rekhmarâ's tomb at Thebes, in Egypt. No doubt of the identity is possible; the further presumption that the pictures of Rekhmarâ's tomb are roughly contemporaneous with the frescoes of Knössos is backed up by the cumulative force of all the rest of the chronological evidence, besides being inherently probable from the almost exact similarity of costume, &c. The date of *c.* 1550 B.C. for the later portions of the Mycænæan palace at Knössos is thus clearly indicated.

These frescoes give us an inkling of the racial type of the Mycænæans. They are not fair-haired Aryans



FIG. 2.—The Fifth Magazine, showing Great *Pithoi* and Receptacles in the Floor.

from the realms of pure myth into those of historical probability? Yet we have what look very much like the remains of a great Cretan power dating long before the Return of the Herakleids, in fact the power and kingdom of Minôs. The evidence of Greek legend can no longer be scoffed at, and the tradition of the Minoan thalassocracy may yet be shown to contain a substratum of historical fact. Those *Keftiu* went far afield: they reached Egypt. Sicily and Kamikos are no farther.

The records of Knössos have much to tell us, but as yet they are dumb. There they lie before us, those queer characters incised on tablets of sun-baked clay, but we cannot read them yet. How long we shall continue in this state of tantalising ignorance it is impossible to tell. The lamentable failure to read the so-called "Hittite" script of Eastern Asia Minor is no good augury.

This discovery of inscribed tablets is the most important in the field of early Greek antiquities since the excavation of the graves at Mycænæ. The tablets, good illustrations of which are given by Mr. Evans, were found in a number of deposits or "hoards" in the palace, mostly packed away in sealed boxes placed in large *pithoi* or handleless vases (a specimen of the kind, brought from Rhodes, is in the First Vase Room of the British Museum), which were stored in special chambers. The writing is of two kinds, hieroglyphic ("pictographic") and linear: in both remarkable resemblances to Egyptian characters are noticeable, and give further proof of the idea, now

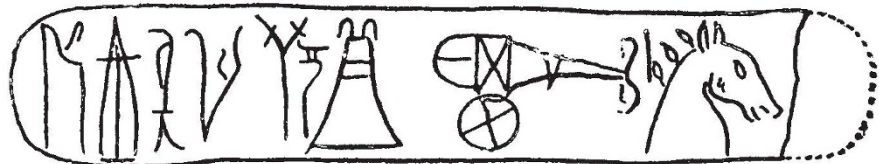


FIG. 3.—Linear Tablet referring to Chariot and Horses and, perhaps, Cuirass. (Size of original.)

at all. They are brunett, black-haired, un-Aryan people like the modern Italians, Greeks and Anatolians; they belong, in effect, to the "Stirpe Mediterranea" of Sergi, the race which we may, if we like, call Pelasgian, which preceded the Aryans in Greece as well as in Asia Minor, and of whose peculiar language-type Karian and Lycian give us a good idea. The Aryan

conquerors gave Aryan languages to Italy, Greece and Phrygia, but the modern speakers of Italian, of Greek, and of Armenian much more closely resemble their non-Aryan ancestors than their Aryan conquerors.

The palace of Knossos was built of great gypsum and limestone blocks, and when complete must have been a most imposing building. One of the most curious facts with regard to it is that it is really built round a small open space, which Mr. Evans speaks of as "The Central Clay Area." "This enclosure," says Mr. Evans (p. 17) "turned out to be entirely devoid of foundations, and its floor was composed of the pale clay already noticed as being of artificial accumulation and as probably due to the disintegration of the clay platforms and wattle-and-daub huts of a very primitive settlement. It was found to be full of Neolithic relics, and a shaft sunk near the N.W. corner showed that the deposit was at this point 7.50 m. in thickness. On the south side this clay deposit

middle of the north wall was an interval between two of these stone benches, the central post of which was occupied by a gypsum throne. The throne rested on a square base and displayed a high back of undulating leaf-shaped outline . . . Its total height is 1.06 m., and the level of the seat 0.56, or 21 cm. above that of the stone benches. . . . The lower face of the throne presented a curious architectural relief, consisting of a double moulded arch springing from flat, fluted pilasters, expanding upwards in the Mycenaean fashion. The upper part of this arch was traversed by a moulded band forming a counter-curve. But the most interesting feature remains to be described. The lower part of the mouldings of the arch on either side were, by a strange anticipation of later Gothic, adorned with bud-like crockets. The architectural features, indeed, revealed by these reliefs are in almost every respect unique in ancient art."



↑ End of Stone Bench in Front of Tank. ↑ Doorway of Inner Room. ↑ Stone Bench and Fallen Fresco. ↑ Throne between Stone Benches. ↑ Wall-projection and Door-jamb.

FIG. 4.—Throne-Room as seen from Antechamber.

merges in a darker soil full of wood-ashes and bones, possibly of a sacrificial nature. The existence of this early site, untouched in the middle of the later palace, suggests curious speculations. We have here, perhaps, the interior of a *temenos* preserved for religious reasons, and the square base of an altar, already noticed, in the eastern bay of the enclosure, confirms the idea of consecration. It may be that the 'Palatine' of Mycenaean Knossos also had its 'Casa Romuli'—a sacral survival of a prehistoric dwelling."

A chamber of great importance in the palace was the Throne-room, of which Mr. Evans gives a description (p. 35 ff.): "The chamber . . . was in many ways as perfect as the room of a Pompeian house, though some fourteen centuries earlier in date. On the south side opened an impluvium and steps leading down to a fine stone tank. . . . Breasting this, and along two other sides of the room, ran gypsum benches with pilasters. . . . At the

tablets of Babylonia, but the letters here are of free upright 'European' aspect, far more advanced in type than the cuneiform characters. They are equally ahead of Egyptian hieroglyphs, though here and there the pictorial original of some of these linear forms can still be detected." This passage is very incomprehensible. In the first place the whole idea of the Knossian tablets is obviously of Babylonian origin: they are not merely "distantly analogous" with the tablets of Babylonia. In the second place, what does Mr. Evans mean by the Mycenaean letters being "of free upright 'European' aspect"? What characters can be called free or unfree? Why is the erect position specially "free" or "European"? The Egyptian hieroglyphs and their hieratic developments stood bolt upright unless a crocodile or a snake were pictured; cuneiform was upright and spiky enough, in all conscience. They are not European. With what European script is he comparing the Mycenaean writing? Surely

A splendid idea of this room and of the now famous "Throne of Minos," can be obtained from the photographs published in the *Annual*, one of which is shown in Fig. 4. In general it may be said that the illustrations are extremely good—the plans also. But for finality in these latter we must wait till Messrs. Evans and Hogarth have brought their excavations to an end. Enough has now been said to give the reader an idea of the immense importance of the discoveries at Knossos, and it is a matter of congratulation that their discovery has fallen to the lot of an Englishman. Our knowledge of early Greek civilisation in Crete now rests on a much surer foundation than it did when Mr. Evans strove to draw a connected story from the evidence of the "Seal-stones" alone.

To one small point only in Mr. Evans's discussion of his discoveries must we take exception. When speaking of the inscribed tablets he says (p. 57): "Some distant analogy may be recognised with the

not with the Greek alphabet, which was of Phœnician, and ultimately of Egyptian, origin. And how are the Knössian characters more advanced in type than the cuneiform characters? Obviously they are nothing of the kind; they are in the same stage of development as the Egyptian hieratic writing, to which they bear a strong resemblance; so far, then, it may be said that they are "ahead" of the Egyptian hieroglyphs; but cuneiform was far more conventionalised, far "ahead" of either Egyptian hieroglyphic and hieratic or Mycenaean linear. The people who used the Knössian script may turn out to have had not one drop of Aryan "European" blood in them, and European-Greek culture may be as thoroughly of non-Aryan (and equally non-Semitic) origin as Semitic culture was in its origin absolutely non-Semitic.

The work of Messrs. Evans and Hogarth at Knossos has been supplemented by the latter with the very interesting results of his excavation of the famous cave of Zeus on Mount Diktê, an account of which appears on p. 94, ff. Mr. Hogarth's story of his operations, of the blasting of the rocks, the unveiling of the most ancient sanctuary of Zeus, the recovery of small bronze double-axes and other votive objects, belonging to the same period as the Knössian palace, from the crevices of the stalagmitic deposit in which they had remained undisturbed for nearly four thousand years, the finding of a little Egyptian bronze statuette of Amen-Râ, which shows that somewhere about 1000 B.C. King Zeus was already identified with Amonrasuntiru, Amen-Râ, king of the gods—all this is of the highest archæological interest, and may be recommended to the notice of students of Greek religion.

It remains to speak of the articles of less importance which also find a place in this number of the *Annual*. That by Mr. F. B. Welch on "The Influence of the Ægean Civilisation on South Palestine" is important as chronicling the occurrence of Mycenaean pottery at a Palestinian site, Tell es-Safi. "This," says Mr. Welch, "was certainly a Philistine stronghold, a fact which is suggestive in view of the probable north-western origin of the Philistines" (p. 119). This is quite true, and it may be remarked that the old tradition of the Cretan origin of the Philistines has lately, in view of the Egyptian records of attacks by the Peoples of the Sea, among whom figure the *Pulesatha* or Philistines, and a great deal of other evidence, both archæological and legendary, come once more to the front, and probably represents a historical fact. But Mr. Welch should note that Semitic authorities such as Delitzsch, Jensen, Mayer and Tiele uncompromisingly claim the Philistines as Semites, and specifically Aramæans. The Egyptian evidence, however, as Mr. Welch rightly implies, goes absolutely against the Semitic claim, which will probably have to be given up. Still, the Greek archæologists have no right to ignore the opinion of the Semitists on such a question as this. Mr. Welch seems, by the way, to attach rather too much importance to purely "typological" arguments derived solely from the study of pottery, which can never be an absolutely infallible guide.

Mr. J. C. Lawson's note on "A Beast-Dance in Scyros" (p. 125) will be of great interest to anthropologists. In carnival time the young men of Scyros array themselves in goat-skin capes—"each does his best according to his lights and his means to look like a goat"—hang goat-bells round their persons and solemnly dance through the town, often stopping "at some friendly door to imbibe spirituous encouragement to further efforts." This is undoubtedly a very ancient survival, and possibly goes back to Mycenaean times, a surmise with which anybody who knows what a great part goat-headed and other theriomorphic figures play in Mycenaean art will probably agree. But alas, "thanks to the steadily increasing

influx of Western culture during the last few years," the goat-mask is often replaced nowadays by "an Ally Sloper mask"! The modern Japanese wears a billycock or a deerstalker on the top of his national historical costume. So the free and upright civilisation of modern Europe dominates the world!

It may be finally noted that the knowledge which the contributors to this number of the *Annual* possess of the German language appears to be defective. If German terms are used at all, their proper plural forms should be given to them. "Bügelkannes" may be Dutch, but is neither German nor English; Mr. Welch gets over the difficulty, which might have been solved by reference to a German grammar, by giving his German words no plural form at all. He speaks of "Bügelkanne" and "Schnabelkanne" when he means *Bügelkannen* and *Schnabelkannen*.

Despite these little imperfections, the sixth number of the *Annual of the British School at Athens* is undoubtedly the most important contribution to our knowledge of the early history of mankind that has appeared for many years.

MAGNETIC OBSERVATIONS DURING TOTAL SOLAR ECLIPSE.

THE effect produced by a solar eclipse on the meteorological conditions of the atmosphere has on many occasions in the past been the subject of observation, but in the number of *Terrestrial Magnetism* just received we find an account¹ of a systematic examination of the influence of such an eclipse on magnetic conditions also. It had appeared to Dr. Bauer, chief of the U.S. Magnetic Survey, that magnetic observations might on such an occasion be usefully undertaken; and the occurrence of the solar eclipse of May 28 of last year, the total phase of which was visible in the United States, afforded an excellent opportunity of carrying such design into execution. For the needs of the magnetic survey simultaneous magnetic observations are made on certain days throughout the year at the different magnetic stations, and it was arranged that such observations should be made, on the day of eclipse, at stations as near as possible to the path of totality. Six stations were selected; three of them—Union Springs, Rocky Mount and Cape Charles—were situated within the path of totality, the remaining three—Salem, Bayard and Gaithersburg—being outside. The observers received instructions to occupy such stations as their special work permitted for the due accomplishment of the object in view, accompanied by a detailed scheme of the observations to be made. The prescribed course was carried out by all the observers excepting the one at Gaithersburg, who for some reason failed to receive his instructions in time; but he made observations according to directions sent him previously, relating to other work. The detailed scheme of observations is given with the view of aiding observers making preparations for similar work on future occasions. The observations made are discussed at considerable length, being accompanied by numerous graphical illustrations, and it is stated that there can be no question that some kind of magnetic disturbance made itself felt on May 28 at every one of the stations.

Finally, the conclusions arrived at are given under eleven separate heads, the principal points of which are contained in the following summary:—A small magnetic oscillation made itself felt at various stations situated in the eastern part of the United States during the time of the eclipse. It was detected by various persons, at various stations, with different instruments, under different conditions, and was also automatically recorded.

¹ *Résumé* of magnetic observations made chiefly by the United States Coast and Geodetic Survey on the day of the total solar eclipse May 28, 1900.