the education of the child easier, will make it vastly more difficult, because it will then be necessary to teach the old system, which will persist in use, and also to teach in fact as well as in name the metric system with the confusing ratios, direct and reciprocal, between the English and metric units.

If any one wants proof of this he can find it in the same French arithmetic. One chapter, 'Nomenclature des anciennes mesures et comparison avec les nouvelles,' treats of old units, a few of which are: *toise, pouce, ligne, aune, pas, lieue, perche, arpent, solive, corde, setier, muid, mine, minot, livre, once, denier, grain.*

If he still doubts let him go to some great French industry, textile manufacturing for example, and there study the chaos of weights and measures, thus described in 1902 by Paul Lamoitier, a French manufacturer:

> We are as much in the anarchy of weights and measures for the textile industry as at the time of the Revolution. * * *
>
> The famous aune, do you know its equivalent? Exactly 3 feet, 7 inches, 10 lines, and 10 points, or in other words, 1.188447 meters; the foot being equal to .324839 meter and divided into 12 inches, the inch into 12 lines and the line into 12 points.
>
> You would not imagine this as you are in the habit of calling it 1.19 meters. You laugh! It is, however, no laughing matter, unless you consider it as I do, profoundly ridiculous. * * *
>
> I will take my oath that the manufacturer of Rouen if he has not studied each section separately, has no idea what is the standard of Reims or the denier of Lyons or Milan. And on the other hand the manufacturers of Reims and Lyons are likewise puzzled in making comparisons of the diverse numberings of the diverse materials.

Such is the condition of French weights and measures at the present time. The evidence here presented is from French sources and makes ridiculous not only the claim of saving in education, but the whole metric proposition as well. This school children fallacy is confined to English-speaking countries where in the absence of experience with the metric system the imagination supplies the foundation for argument. The French labor under no such delusion.

Of course, if they insist, English-speaking countries can learn about the metric system in the high priced school of their own experience, but more than a century of experience in France can be had without money and without price.

Samuel S. Dale.

Boston, Mass.,
March 27, 1905.

### WILL THE METRIC SYSTEM SAVE TIME IN EDUCATION?

In the article entitled, 'The Metric Fallacy,' Science, March 3, p. 353, is the statement that, in the New York public schools: 'The time allotted for all branches of mathematics amounts to $34\frac{1}{8}$ weeks for the eight years.' These figures relate to the actual time spent in recitation, which extends through nearly one year of school life, that is, about one eighth of the entire time. A complete education, to which Lord Kelvin referred in the British Parliament, includes high school and college, eight years more, which, with the same division of time, gives two years of solid mathematics. In England, one sixth, instead of one eighth is given to mathematics, and it is not extravagant to say that one half of this is wasted because of our barbarous weights and measures. Part of the economy of time shown in this country is due to our decimal money, part to the disuse here of many of the old English measures still taught in the English schools, and part to the greater use here of the metric system in our higher education, or perhaps it would be more correct to say, the non use therein of the English system.

Wm. H. Seaman.

## SPECIAL ARTICLES.

### THE PELÉ OBELISK ONCE MORE.*

The recent massive-solid extrusion from within the crater of Mont Pelé has been de-

* Descriptions of the 'dome' and of 'spine' or 'obelisk' of Mont Pelé, with references to many previous papers relating to the volcano, may be found in: Hovey, E. O., 'The New Cone of Mont Pelé and the Gorge of Rivière Blanche,' in *American Journal of Science*, Vol. XVI., 1903, pp. 269–281. Hovey, E. O., 'The 1902–1903 Eruptions of Mont Pelé, Martinique, and the Soufrière, St. Vincent,' in *Comptes Rendus IX. Congrès géologique international*, de Vienne, 1903, pp. 707–738.

scribed by several observers as consisting of two parts: a 'dome,' and a 'spine' or 'obelisk.' The former was a dome-shaped elevation developed within the crater, which occupied a large portion and in fact nearly the whole of its interior and overtopped its rim. It was situated directly over the volcano's conduit, and numerous explosions occurred in its summit portion. The latter, *i. e.*, the 'obelisk,' was situated on one side of the dome and rose as a mighty tower to a height of more than a thousand feet above it. While the two structures just referred to have been described as distinct, perhaps in part for convenience in recording observations, there seem to be good reasons, as will be stated below, for considering them as parts of the same massive-solid extrusion or, as termed by some writers, 'cumulo eruption.'

In explanation of the upheaval of a mighty spire or obelisk of rigid rock from within the crater of Mont Pelé, two hypotheses have been offered. The obelisk has been considered by several geologists as the freshly congealed and rigid summit portion of a column of molten rock or magma, which was forced out of its conduit in a massive-solid condition. A second hypothesis, advocated by Angelo Heilprin,* is in brief, that a plug of old lava, formed by the cooling and hardening of a residuum left in the conduit of the volcano after some previous eruption, was forced upward and in part extruded from the crater.

Of these two hypotheses the known facts seem to favor the acceptance of the first mentioned, for the reason, in part, that the decidedly vigorous eruptions of the volcano, especially during the earlier stages of its present period of activity, when vast quantities of fragmental material were ejected, show that the conduit had what may be designated as a free vent. The large size of the column of black, debris-laden steam, estimated at 1,500 feet in diameter at the base, which at times rose straight into the air for several thousand feet, is also proof that the conduit was not seriously restricted in its upper portion, and demonstrates that one large opening and not several small orifices was present. The great amount of dense and seemingly old lava mingled with scoriaceous and fresher appearing material which has been discharged, is apparently good evidence that the plug of old lava present in the conduit when the recent eruption began, was, in part at least, shattered and the fragments, together perhaps with masses of similar material torn from the walls of the conduit, widely distributed as ejected blocks, lapilli, dust, etc. There are still other considerations which favor the idea that the obelisk was formed by the recent congealing of a rising magma, rather than that it was a solid mass at the beginning of the recent period of activity. Among these considerations is the fact that the total vertical measure of the massive-solid extrusion, in case the obelisk had not in part fallen from time to time, would have been some five or six thousand feet. The frictional resistance of such a plug, if rigid throughout, would, as it seems, have been greater than even volcanic energy could have overcome, and certainly far greater than is demanded by the hypothesis that a magma was cooled and consolidated in its upper portion as it rose from below. Then, too, as observation seems to indicate, Mont Pelé is composed principally of fragmental material ejected during previous eruptions, and the walls of the present conduit may reasonably be assumed to be relatively weak, and in case it had contained a solid 'volcanic neck' to a depth of five thousand or more feet, the fresh discharges would have found an exit by means of a new or side opening instead of pushing the plug out vertically and causing explosions about its periphery.

Recorded knowledge concerning volcanoes is still too incomplete to enable one to form a well-substantiated judgment as to the manner in which the reopening of a conduit is accomplished after a period of quiescence and apparent extinction, but the best tentative view in this connection seems to be that a magma in a volcanic conduit requires a long period of time, possibly several thousand years, to lose sufficient heat to admit of a change to a solid

* Heilprin, Angelo, 'The Tower of Pelée,' published by J. B. Lippincott Co., Philadelphia and London, 1904, size 9 by 12 inches, pp. 1–62 and 22 plates.

condition to a considerable depth. When pressure is renewed at the base or basal portion of a conduit after a period of rest, presumably the still hot material contained in it would afford the path of least resistance for the ascent of material forced upward from deep within the earth, and the former avenue of discharge would be reopened. As will be shown later, there are reasons for assuming that the magma in the conduit of a dormant volcano solidifies progressively from its periphery towards its center, and that previous to complete consolidation there is a tube of rigid lava present, enclosing a vertical core of plastic or liquid rock. The summit portion of the material in the conduit of a dormant volcano, however, is always rigid and must be fractured and the fragments produced ejected, or else heat ascending from a depth, perhaps conveyed by gases and vapors, leads to a sufficient increase in temperature to cause the previously solid lava forming the summit of the plug to become partially or wholly viscous. Should a condition of inactivity continue sufficiently long to permit the magma in a volcano's conduit to become solidified to a considerable depth, say several thousand feet, it is reasonable to assume that a truly extinct condition would be reached and that an increase of pressure at a depth would lead to the formation of fissures and the opening of a new conduit.

The speculations just indulged in seem to favor the hypothesis that the obelisk of Pelé was composed of fresh lava in distinction from lava formed by the secular cooling of a magma left in the conduit at the close of some former eruption. On the other hand, the change of a fresh magma, rising from a depth, to a solid condition as it nears the summit of its conduit, implies a very rapid rate of change from a plastic to a rigid condition. In this connection it is to be remembered that during a certain period of eighteen days the growth of the obelisk of Pelé was at the rate of about forty-one feet per day. The suggestion here presents itself that the rate of downward progressing change from a plastic to a rigid condition might not have been the same as the rate of bodily ascent. Most probably each process was variable. The portion of the obelisk extruded during a certain period of time may have required a longer period of time for its consolidation.

Under the assumption that the obelisk of Pelé was composed of fresh lava, two chief methods or processes have been suggested by which a change from a plastic to a rigid condition of the material extruded was brought about. One of these explanations and the one I have previously favored, ascribes the loss of heat from the magma in the summit portion of a volcano's conduit, mainly to conduction through its confining walls, aided, and perhaps dominated by, the cooling influence of descending percolating water. Assuming that this is the main process involved or the one as may be said in control, it follows that the magma adjacent to the walls of the conduit in its upper portion would change to a solid condition previous to the central part; that is, in a given horizontal section consolidation would progress from the circumference toward the center. Coupled with this process and as it seems an accompaniment of any method of cooling after the protrusion of solid material has begun, is the loss of heat from the exposed summit-portion of the column by radiation, escape of steam and gases through fissures, the cooling influences of rain, etc.

Another process by which the cooling of a magma in the summit-portion of a volcano's conduit may be brought about, has recently been suggested by A. C. Lane* and G. K. Gilbert,† and is based on the principle that vapors and gases on expanding withdraw energy from surrounding media, the assumption being that a rising magma near the condition of consolidation and containing occluded vapors and gases, would experience a decrease of pressure as it rose; and in consequence the vapors and gases would expand and withdraw heat from the walls of the containing vesicles and promote their solidification. The application of this principle to rising magmas seems to be legitimate, but implies that material is removed from the summit of the ascending column; if the material dis-

* Science, December 11, 1903.

† Science, June 17, 1904.

charged is all in a massive-solid condition, as, for example, in case a solid plug is forced out of a volcano's conduit, there would be no loss of pressure so long as the plug or obelisk remained intact—except the probably negligible part due to decrease in atmospheric pressure with increase of ascent above the summit of the conduit—and consequently, no tendency to upward expansion. As the extruded material emerged from its conduit, however, there would be a conspicuous decrease in resistance to lateral expansion and the mass should enlarge laterally, and in consequence cool most rapidly by reason of the expansion of occluded steam and gases, in its peripheral portion. That is, there would be a tendency for the extruded mass to expand horizontally on escaping from its conduit, and the energy so utilized would decrease the tendency to upward expansion. The higher the mass rose above the summit of its conduit the greater would be the pressure on its basal portion due to its increasing weight, and for this reason, also, there would be a tendency toward basal enlargement. By reason of these two processes, in case no loss was sustained owing to explosions, dislodgment, etc., there would be a tendency for the rising mass to assume a bottle shape, *i. e.*, a circular tower with an expanded base.

The two methods of cooling just considered have a joint tendency to cause the outer portion of the ascending mass to become rigid at an earlier stage than the central portion, and hence to form a hollow rigid tube enclosing a more highly heated and perhaps still plastic central core.

An inspection of the admirable photographs of the obelisk taken by E. O. Hovey, Angelo Heilprin and others, shows that it was situated sub-centrally in the crater from which it was extruded, and adjacent to its northeastern border. The side facing the center of the crater was rudely concave and its outer margin in horizontal section, somewhat definitely convex. The photographs also indicate that subordinate crags within the crater and in part adjacent to the base of the obelisk, were so arranged that in a horizontal section at the level of the crater's rim they, together with the base of the obelisk, formed a rude circle. These deductions, together with the fact that explosions occurred from time to time at the base of the obelisk and, as seems to have been the case, mainly on its southwestern or inner side, suggest that the tower-like mass was a portion of the encircling wall of an essentially hollow plug of rigid lava constituting the new dome, which was forced upward and out of the summit of the volcano. That is, the obelisk was a portion of the wall of a tubular plug, the greater portion of which became broken and was dislodged as it rose. The 'cork,' in other words, was not solid throughout in cross-section, but composed of a rigid enclosing wall, with less rigid and perhaps still plastic material in its central portion.

If the above deductions from the study of photographs and the observations of others are well founded, they certainly indicate that the cooling and consolidation of the magma in the conduit of the volcano progressed from its periphery toward the center. At the same time, whenever portions of the summit of the column were removed by explosions, or a portion of the obelisk fell—there having been no overflow of molten lava—decrease of pressure on the part remaining must have occurred, thus favoring consolidation throughout the summit-portion of the truncated column on account of the expansion of occluded steam and gases as outlined above.

It is suggestive to note also, as having a bearing on the general process of volcanic eruption, that relief of pressure brought about in the ways just considered, would favor a renewed ascent of the material remaining in a conduit, and likewise a renewal of explosions at its summit.

In the light of the hypothesis that peripheral cooling was the controlling condition in the case of the recent massive-solid eruption of Mont Pelé, several seemingly discordant observations may be grouped in orderly sequence. For example, the conical mound of rough, glowing lava present in the crater and resembling a 'cone of eruption' during the days immediately succeeding the great eruption of May 20, 1902, may be considered as the congealed summit of a column of fresh lava which rose in the volcano's conduit. Beneath this hot and steaming initial plug, as may reasonably be assumed, the heat increased and the solid lava passed gradually into still plastic magma below. Cooling continued not only at the summit of the column as it rose on account of radiation, the escape of steam and gases from fissures, etc., and as has been suggested, on account of the expansion of steam and gases occluded in the magma, but also, and at a maximum rate, adjacent to the walls of the conduit principally through the influence of conduction and the ingress of surface water. The rise of the column, owing to pressure at its base, caused it to protrude from its encircling crater, but portions of its rigid wall fell or were shattered by steam explosions in its central part and only the remnants left standing reached a conspicuous height. The changes in the position of the obelisk as observed from time to time seem consistent with the explanation just offered, since the fall of one prominent spine or obelisk would leave some other portion of the rim conspicuous, and as it in turn was forced upward, seem to take the place of its fallen predecessor.

The fact that the outer surface of the obelisk, *i. e.,* its northeastern side, was striated vertically, owing to friction against the wall of the conduit from which it was protruded, is evidence that there was but little if any opportunity for steam to escape from below in that portion of the periphery of the crater. If the rising plug fitted its conduit equally well all about its contact with its enclosing conduit, it is difficult to understand where the numerous steam explosions which are known to have occurred adjacent to the base of the obelisk, were located—in case the plug was solid throughout its summit-portion. On the other hand, if it is assumed that the inner part of the rising column was less rigid than its outer portion, and as is consistent with this idea, perhaps even plastic at the center, it is legitimate to infer that the central portion of the summit of the rising column was removed by steam explosion, at the same time that the more prominent crags on the crest of its rigid peripheral portion were caused to rise high in the air.

Another series of facts which demands consideration in the above connection is that the rate of ascent of the dome and of the obelisk was not the same. Explosions occurring in the summit of the dome removed portions of its mass and a similar result was brought about in the case of the obelisk by the dislodgment of fragments. Varying conditions were thus introduced, but so far as can be judged the rate of ascent in either instance did not respond to these changes. Why the energy exerted in causing the massive-solid extrusion was not all consumed in elevating the core of the plug, where the resistance from weight was the least, and where the temperature was highest and consequently the tendency to plasticity the greatest, is far from clear. This is one of the considerations which advocates of the 'fresh lava hypothesis' to account for the production of the Pelé obelisk are called upon to meet. But in this connection, as in reference to the rapid rate of cooling demanded by that hypothesis, an adequate explanation does not seem to be at hand.

*Sequence of Events.*—The sequence of events during a massive-solid volcanic eruption, and the leading variations in what may be termed the normal process due to secondary conditions, may provisionally be grouped as follows:

If the magma forced upward from deep within the earth, through a volcano's conduit, becomes highly viscous or nearly solid before reaching the surface, it may be forced out of the conduit and expand in the crater to which the conduit leads. The amount of expansion will depend principally on the degree of plasticity of the mass, the range being from such a degree that the material will flow under the influence of gravity, to rigidity under the pressure present. The distinction between an effusive and a massive discharge is that the material extruded in the former instance is sufficiently mobile to flow and possibly to form a well-defined stream, and in the latter instance is so viscous or even rigid that lateral motion does not result. Between the two there is a complete gradation. The range in the physical condition of the extruded lava is from fluidity approaching that of water, to rigidity such as cold lavas ordinarily present.

The constructional shapes resulting from the extrusion of lava ranging in consistency from a highly viscous to a rigid condition, should form a sequence from irregular tumefactions and bottle-shaped towers, to angular crags with nearly vertical sides. A sequence of variations should also be produced owing to the amount of material extruded, its rate of ascent, etc. The constructional topographic forms should present destructional modifications, in case explosions occur, or portions of the extruded material are dislodged.

The results produced by massive-solid eruptions, as may be judged if all the modifying conditions are considered, are so varied that it is not practicable at present to follow each modification in detail. The place of the Pelé obelisk in the general sequence, however, may be readily indicated.

Under the hypothesis that the Pelé obelisk was composed of fresh lava, which congealed and became rigid, at least in part, as it rose through its conduit, and was protruded high in the air, let the reader endeavor to construct in fancy the topographic form that would have resulted, had there been no explosions and no loss owing to dislodgment. Under these assumptions the outer portion of the extruded mass would cool more rapidly than its central portion, and the surface might become rigid while the core was yet plastic.

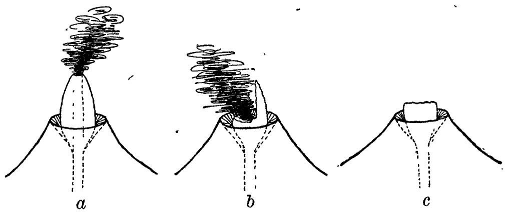


FIG. 1. Ideal diagrams illustrating the shapes of massive-solid volcanic extrusions.

The extruded material at an assumed stage in the eruption would have some such form as is outlined in Fig. 1, *a*. At such a stage the highly heated core of the extruded column might serve as a continuation of the conduit and an escape of steam possibly with explosive violence and accompanied by fragmental discharges, occur in the pseudo-crater at its summit.

Providing explosions occurred as the dome rose, it might be more or less shattered. Vigorous explosions might remove the summit-portion of the ascending mass as fast as it was forced out of its conduit, and the fact that a massive-solid extrusion had occurred be masked so as to make it appear that only a fragmental-solid eruption was in progress or had taken place. It should be borne in mind that effusive, fragmental-solid and massive-solid eruptions with all of their varied accompaniments are but phases of a single process.

Vigorous explosions during the ascent of a column similar to the one suggested in Fig. 1, *a*, might cause the removal of a part of the material composing it, leaving portions of its solid exterior standing as angular crags and tower-like spines as shown in Fig. 1, *b*. This diagram, as the reader will recognize, is intended to indicate in outline—all suggestions as to accumulation of débris, and other secondary results being eliminated—the condition of the massive extrusion in the crater of Mont Pelé at the time the obelisk was most prominent. During the continuance of the conditions indicated in the diagram, vigorous explosions might occur in the truncated summit of the 'dome' while portions of its shattered periphery formed conspicuous eminences. Explosions of this nature, as has been observed, occurred in the summit of the 'dome' of Mont Pelé; and, as it is reasonable to assume, the final fall of the obelisk was due chiefly to the shocks caused by explosions at its base. The general shape that the extruded material would present after being truncated by explosions, is roughly indicated by Fig. 1, *c*.

The considerations just presented seem to make it reasonable to conclude as already stated, that the 'dome' and the 'obelisk' of Mont Pelé were parts of the same massive protrusion and that the various shapes assumed from time to time were due mainly to the shattering and in part the dispersion of the rising mass by steam explosions; also, that the material extruded in a massive condition consisted of fresh lava which was forced outward from deep within the earth. The observed results appear, also, to be consistent with the view that the cooling of the material extruded progressed most rapidly in its peripheral portion and that its central portion, particularly after partial truncation had occurred, was sufficiently hot to cause explosion accompanied by fragmental-solid discharges.* If these contentions are well founded, it follows that the exterior of the plug—considering the dome and the obelisk as portions of a single extruded mass—should be composed of dense and possibly vitreous rock, and become more and more scoriaceous towards its center.

The above suggestion in reference to the physical condition of the extruded material differs from the conclusion reached by me in the same connection, in a previous publication,† which was based largely on the observed granular condition of the rock present in the central portion of a massive-solid extrusion near Pauline Lake, Oregon.‡ This discrepancy seems to indicate that the conditions which modify massive-solid eruptions are more varied than is at present understood and that the results in any two instances may not be closely similar.

The theory of volcanic eruptions may instructively be pressed a step farther: As the cooling and consequent consolidation of a magma forced out of a conduit in a viscous or solid condition, progresses from its periphery towards its vertical axis, it follows that in case a volcano becomes dormant the same process will continue in the deeper portions of the conduit, and should eruptions be renewed after a period of rest, the avenues of discharge should be through the central part of the partially consolidated material in its throat. In case the energy of the renewed eruptions was not sufficient to fracture and discharge, or the heat adequate to re-fuse the consolidated lining of the conduit, it would remain, and if the process was repeated, the tube would become closed by successive additions to its rigid lining, and final extinction result.

In the case of Mont Pelé, the process just outlined is, perhaps, in progress, and the dense rocks in the rim of the crater, which form Morne Lacroix and Petit Bonhomme, be representatives of the outer portion of a previous eruption similar to the one of recent occurrence.

*Generalizations.*—The various forms which massive-solid volcanic eruptions may be expected to assume should be regulated by several secondary conditions, a number of which might be in operation during a single period of discharge, or some one dominate all the others. For example: (1) the physical condition of the extruded material may range from plasticity to rigidity, dependent upon the chemical composition of the rising magma, its temperature, rate of cooling, rate of ascent and probably still other conditions; (2) the degree of explosive energy may range from such intensity that the entire summit-portion of the extruded material would be blown away, to such feebleness that but little change would be produced in the constructional form due to extrusion; (3) differences in the rate of cooling and consequent consolidation may result in the formation of a solid plug, or a plug with a rigid exterior and a still plastic interior. Each of these various conditions would react on many, if not all, of the others, and in consequence the variations in the final result,

* The above considerations seem to be in harmony with the results reached by A. Lacroix, in a recently published volume ('La Montaigne Pelée et ses eruptions,' Paris, 1904). This report has not reached me, but a review by Ernest Howe, SCIENCE, April 14, 1905, contains the following statement: "Lacroix denies that it (the dome) is of fragmental nature and states that it is, in fact, a homogeneous mass of viscous lava surrounded by an envelope of the same substance cooled and consolidated. * * * The viscous magma on reaching the surface through the throat of the volcano and forming a protuberant mass is quickly surrounded by a solid shell or envelope which protects the still pasty interior from a too rapid cooling."

† Russell, Israel C., 'Criteria Relating to Massive-Solid Volcanic Eruption,' in *American Journal of Science*, Vol. XVII., 1904, p. 264.

‡ Mount Newberry, U. S. Geological Survey, Bulletin No. 252, 1905, pp. 97, 106–109.

whether considered geologically or topographically, have a wide range.

It is to be remembered, however, that massive-solid eruptions are but one phase of the volcanic problem and, for their complete elucidation, should not be rigidly separated from other phases of the same process.

ISRAEL C. RUSSELL.

## RECENT VERTEBRATE PALEONTOLOGY.

### FOSSIL MAMMALS OF MEXICO.

THE mammalian paleontology of Mexico offers a most interesting field for investigation, since it promises to reveal the southern range of many North American Miocene and Pliocene types, as well as the northern range of South American types, Pliocene and Pleistocene, in addition to many types which will be found to be peculiar to Mexico. The literature of the subject is still quite limited, including contributions by Richard Owen,* by Professor Cope† and a recent interesting memoir by Dr. M. M. Villada,‡ of the National Museum of Mexico.

In connection with the proposed visit of the International Geological Congress to Mexico in the summer of 1906 the following cursory notes may be of interest.

The elephant remains in the National Museum have usually been ascribed to *Elephas columbi;* but they include molar teeth not only of this species, but of the much larger form, *Elephas imperator.* In the collection of the Geological Survey of Mexico in the new survey building are the skull and tusks of an *E. imperator* of magnificent proportions, the tusks measuring 5 m. 10 cm., or 16 feet 10 inches, in length; this specimen was secured during the excavations for the great drainage canal of the Mexican Valley. Owen's type of *Equus conversidens* and *Equus tau* from the valley of Mexico belong to the National Museum, but are not at present accessible, owing to changes in the building. There is, however, the skull of a Pleistocene horse from the valley of Mexico referred by Villada to *E. excelsus,* but probably belonging to a distinct and much more massive type of animal with exceptionally powerful postorbital arches. Here also is found the fine carapace of a glyptodon (*Glyptodon mexicanus*).

The new building of the Geological Institute of Mexico is being pushed forward to completion with a view to the visit of the International Geological Congress. The director, Dr. José G. Aguilera, very kindly exhibited to us the chief specimens of mammalian fossils. These include the skull of a mastodon probably related to the South American *M. humboltii,* the palate and teeth of a small variety of horse of the size of a donkey, labeled by Castillo in 1866, but not yet described. Besides the skull above noted there are several single teeth of *Elephas imperator,* molars of the *M. humboltii* type from Chiapas, of the *E. columbi* type from the village of Zacapù in Michoacan, of *E. imperator* from the valley of Puebla. In a bed of lignites, probably of Upper Miocene or Loup Fork age, were found the types of *Hipparion* (=*Protohippus*) *castillei* Cope, and teeth belonging to *Mastodon floridianus,* also teeth of the peccary. Also probably of Loup Fork age from the valley of Toluca is the jaw of a rhinoceros, a very short-skulled type, the canines being separated by very short intervals from the premolars, while the molar teeth are exceptionally long-crowned. Very large horse teeth found in the

* Owen, R., 'On Fossil Remains of Equines from Central and South America referable to *Equus conversidens* Ow., *Equus tau* Ow., and *Equus arcidens* Ow.,' *Phil. Trans.*, 1869, pp. 559–573. 'On Remains of a Large Extinct Lama (*Palauchenia magna* Ow.) from Quaternary Deposits in the Valley of Mexico,' *Phil. Trans.*, 1869, pp. 65–77.

† Cope, E. D., 'Review of Dumeril et Bocourt's Mission Scient. Mexique,' *Amer. Nat.*, Vol. XVIII., 1884, p. 162. 'Gigantic Bird from Eocene of Mexico, *Diatryana Gigantea*,' *Pr. A. N. S.*, 1876, p. 10. 'Extinct Mammalia of the Valley of Mexico,' *Proc. Am. Philos. Soc.*, Vol. XII., 1884, 117, p. 1. 'Report on Coal Deposit near Zacualtipan, Hildalgo, Mexico,' *Proc. A. P. S.*, XXIII., 122, 1885, p. 1. 'The Comision Cientifica of Mexico,' *Amer. Nat.*, XIX., 1885, p. 494.

‡ Villada, Manuel M., 'Apuntes acerca de la fauna fosil del Valle de Mexico,' *Anales del Museo Nacional de Mexico*, T. VII., Entrega 14, Ma, 1903, pp. 441–451, 8 pll.