tion of the narrow bands formed by the marine stages in Mississippi and Alabama; with a manifest north-westward trend of such deposits as are continuously traceable in north-western Louisiana, while the later stages are abruptly deflected to the south-west, — all points to a rapidly progressing elevation of the axial cretaceous trough, that may, or may not, have completely separated the interior from the Gulf waters before the beginning of the tertiary period. In any event, the region referred to appears to me to be a critical one, deserving of exhaustive examination in advance of many others that offer only a subordinate interest in comparison to the problem of the correlation of the intracontinental and the marine tertiary. E. W. HILGARD.

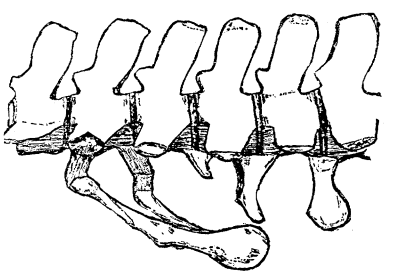
Berkeley, Cal., May 17.

The pelvis of the dugong.

As far as I am aware, the pelvis of Halicore australis has never been properly described or figured.

Last fall I had the opportunity of examining, here at my father's establishment, six ligamentary skeletons, embracing both sexes, of this animal. A few hasty notes made at the time, and a section of vertebrae, including the pelvis (in which, unfortunately, the ischia have been torn asunder and separated from their haemapophysis), is all the material I can lay hands on, now that I have time to look the matter up: consequently my drawing and description cannot include a few points that I would wish.

In all six cases the fourth post-dorsal vertebra is the first sacral. The ilia are connected to the distal



ends of its diapophyses by short ligaments. The ends of these diapophyses are greatly swollen dorso-ventrally, their vertical diameter being thirty-three millimetres, whereas the preceding one measures but ten millimetres. The diapophyses of the two succeeding (sacral) vertebrae are also decidedly thicker at the ends than is the case in either the last lumbar or the succeeding caudals. Anchylosed to the ilia are the ischia lying in the same line, and showing their junction by a prominent swelling in the mass of the bone.

The distal ends of the ilia were connected with each other by a short ligament, and separated from the apex of the haemapophysis of the second succeeding vertebrae by but a few millimetres, connected to it either by a ligament or muscle, but which it is now too late to determine.

The ilium is 109 millimetres in length; the ischium, 102; the transverse diameter of its distal end, 46; the anterior-posterior length of the symphysis ischia, 34.

The first haemapophysis consists of two straight V-shaped bones 30 millimetres long, 29 millimetres apart at bases, with points diverging to a distance of 51 millimetres. The next, to which the ischia join, has its two parts curving inward, leaving an oval opening, the extremities not quite meeting, and ligamentously connected. The succeeding haemapophyses have their ends anchylosed, and are V-shaped.

The point that I especially wish to emphasize is, that the pelvis is not *vertical* to the axis of the vertebral column, but lies at practically the same angle as ordinarily obtains in the mammalia.

In the six specimens examined, two had nineteen thoracic vertebrae, while four had but eighteen. All had three lumbar vertebrae. The thoracic are generally stated as being nineteen in number: with these this was the exception.

It is further to be noticed that the dugong appears to be an exception to the rule that when the number of thoracic vertebrae is increased or diminished there is a compensating diminution or increase in the number of lumbar vertebrae. HENRY L. WARD.

Rochester, N.Y., May 24.

A cretaceous river-bed.

The springs at San Marcos, Hays county, Tex., where the San Marcos River rises full grown from the earth, with a steadiness of flow in marked contrast with the majority of Texas rivers, are, aside from their scientific aspects, sufficiently interesting to have been a subject of popular speculation and newspaper discussion ever since the settlement of Texas. The theories that have been advanced are various, from the popular idea that it is sufficiently explained by the presence of a cave full of water under the hill, to the explanation proposed by an imaginative newspaper editor, that the water comes underground from the Rocky Mountains.

I have not felt it necessary to familiarize myself with the details of this discussion, since, although my conclusions may be to some extent old, the proof is certainly new; for the general principle upon which it is based has been but recently announced by Mr. Robert T. Hill in the *American journal of science* for April (xxxiii. p. 29); namely, that there exists between the earlier cretaceous strata of Texas and the superimposed rocks a plane of 'non-conformity by erosion,' indicating an interval of emergence between the two periods of cretaceous rock formation.

The strata in the vicinity of San Marcos not only furnish a striking proof of the truth of this principle, but they become a key to whatever is mysterious in the origin of the San Marcos River.

The accompanying section roughly represents the rocks exposed by the San Marcos at its source.

No better stratigraphical landmark than the stratum *bb*, the Exogyra arietina marl, could be desired. The exposures at San Marcos are typical ones, containing an unusually large proportion of perfect bivalve specimens of Exogyra arietina R., besides the usual smaller quantity of Gryphara Pitcheri, etc. Its exposures are from fifty to one hundred feet above the river-level, and, in connection with the Ostrea carinata bed below, furnish conclusive proof that these rocks are of the Washita division of the *earlier* or Texas cretaceous; lacking, however, the uppermost members of that series.

In the little valleys back of the portion of the section marked *aa*, I found a conglomerate composed of fragments of the hard earlier limestones and

pebbles cemented with white limestone, and gradually changing upward into a firm, barren, homogeneous limestone.

This formation was in continuation of, or sometimes below, the horizon of the Exogyra arietina marl. Here, then, was the solution of the problem of the San Marcos. The rocks before me were of the *later* cretaceous, deposited upon the gravel and shingle which had formed the bed of a river during the period of emergence. They had choked up and rendered impervious the superficial layers of the river-bed, but doubtless left the lower gravel and sand beds in as good condition for carrying water as ever. To make the evidence complete, I found, on examination of the rock *aa*, which lies only a few feet above the river, that it is the soft limestone of the later cretaceous, containing numerous specimens of Gryphaea laeviuscula R., — a fossil found in great abundance a short distance east and north of Austin, and there occurring at the top of the Austin limestone.

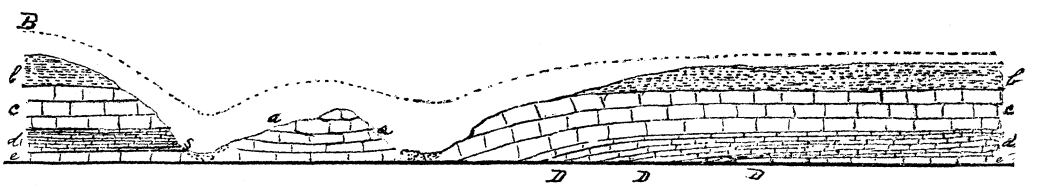
We have, then, the channel, and need only to account for the water to fill it. The Blanco River, in a westerly direction from San Marcos, is about fifteen miles distant. In the upper part of its course it is a running stream of considerable volume; but that the whole of the old bed is to some extent permeated by the waters of the underground river.

The extent and direction of this underground channel, and the determination of other streams than the Blanco which may be tapped by it, are promising subjects of future investigation, which I hope at an early date to undertake, not only in the hope of gaining, by a study of the amount of erosion of the older rocks, some idea of the duration of the interval between the two periods of rock formation, but of obtaining some information concerning the fresh-water life of that period. EDWIN J. POND.

Austin, Tex., May 18.

Electrical phenomena at the Washington monument.

In various numbers of *Science* of recent dates have appeared notices of certain electrical phenomena experienced on western mountain-peaks. The peculiar effects experienced consist in general of a hissing or crackling sound accompanying single discharges, or a continuous flow of sparks, and the characteristic tingling sensation when a finger is presented to any metallic object near by. These experiences, despite the common belief, are not rare,



SECTION OF CRETACEOUS ROCKS AT SAN MARCOS, HAYS COUNTY, TEX., LOOKING SOUTH.

DDD, principal springs; *B*, hill upon which is the Chautauqua assembly building; *aa*, later cretaceous limestone, with Exogyra laeviuscula R.; *bb*, Exogyra arietina marl; *cc*, firm limestone, with Terebratula Wacoensis R. and Pecten quadricostatus Sowerby; passing into *dd*, thin-bedded soft limestone, with Ostrea carinata Law and numerous fossils of types Ostrea, Gryphaea, Turritella, Pecten, Cardium, Cypricardia, Trigonia, Toxaster, and Ammonites; *ee*, hard but broken limestone, with Caprinas.

below the point west of San Marcos it loses size rapidly, and at the point where the International and great northern railroad crosses it, and below, it is for the greater part of the year only a dry bed with occasional pools of standing water.

It has evidently cut through the overlying deposits, till it has reached the ancient bed of the San Marcos, which, thus filled with water, has been enabled to clear away whatever later deposits lay upon its ancient bed back to the present source of the San Marcos River.

To a geologist the question would at once occur, Why has not the current opened the whole of the old bed, and so caused the abandonment of the present bed of the Blanco long ago? The answer lies in the configuration of the older cretaceous strata at its present source. The old river had cut under what was the overhanging cliff of the hard limestone *cc*, causing it to dip abruptly, as represented in above section, and then found the least resistance in cutting a channel from the softer Ostrea carinata bed rather than in carrying away the fallen mass of the harder limestone. Hence the rocks of the old river-bed proper, at *aa*, though very soft, are protected from further erosion from beneath by the stratum *cc*.

There are, however, small springs at *s*, which show

nor confined to certain persons. At Pike's Peak these electrical manifestations are of frequent occurrence, and a list has been published (*Report of chief signal officer*, 1882, p. 893) showing the accompanying meteorological conditions in fifty-six instances, and proving that these electrical phenomena are closely connected with the occurrence of hail, snow, and thunder-storms. At these times it is easy to obtain sparks from woollen or fur garments, and to receive shocks on opening the door of the stove, or touching any metallic body. Again, at Fort St. Michael's (*Ibid.*, 1881, p. 768) during the coldest weather of winter, and always after a snow fog, "the air is so electrified that the hair upon any loose fur stands up, and a spark can be drawn by presenting a finger to the tip of a single hair."

In all these cases the observer may be considered as an insulated (perhaps, as in the case of one of your correspondents, he may stand upon a thick woollen Navajo blanket) body, which, because of the electrification of the air, acquires a charge. Contact with a body, in better, although perhaps not very good, connection with the ground, results in a discharge, with the described effects, varying in intensity with the degree of electrification. This condition of things is in part, I think, imitated in some experiments I have made at the top of the Washington