is about 1.01, the true volume of the solid matter is about 38 percent of the apparent volume of the spine. On ignition a fragment does not disintegrate but retains its original form.

As described by previous writers, the solid matter appears to form a continuous framework. Distances between neighboring structural elements are not uniform, but are estimated to range between 0.01 and 0.10 mm. The refractive indices are nearer to those of calcite than to those of aragonite. The optic axis lies parallel to the long axis of the spine. On immersion in bromnaphthalene the cross section shows a fairly good uniaxial negative interference figure, although, as would be expected, the figure is distinct only in the neighborhood of the centered optic axis. In spite of the brittleness of the material, three cleavage planes may be found in positions approximating those of calcite, but the mat character of these surfaces makes goniometric measurement impossible.

In the X-ray examination, *c*-axis rotation photographs and basal Laue photographs were obtained. All X-ray data point to the definite conclusion that the entire spine is a perfect single calcite crystal with the *c*-axis parallel to the long axis of the spine. None of the three crystallographic symmetry planes, however, appears to coincide with the external symmetry plane of the spine examined—a condition that was also suggested by the cleavage tests. It will be recalled that Laue photographs are quite sensitive to slight imperfections in internal structure. Although for each photograph there were many structural elements in position to diffract (the diameter of the X-ray beam and the thickness of the section each being about 0.5 mm.), the diffraction spots were always sharply defined and showed no indication of twinning or imperfect orientation. In quality the photographs were similar to photographs of calcite made for the purpose of identification and comparison.

Among crystalline mineral species found in living organisms are calcite and aragonite in sea shells, apatite in bones and teeth, and whewellite in some plants. In such organisms the crystalline phase is generally an aggregate of small discrete crystal grains whose orientation is either random or to some extent parallel along one or more crystallographic axes. The skeletal parts of the echinoderm, as we have seen, differ from other organisms in that single large functional units are built around single *continuous* calcite crystals. They thus offer a very special problem in the broad subject of crystal growth. They likewise draw attention again to the often remarked parallelism between the phenomena of biological growth and crystal growth, which two processes here take place concomitantly and *κατ ἐξοχην*.

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NOTES ON THE CRANIOMETRY OF *EQUUS SCOTTI* GIDLEY

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The purpose of these notes is to put on record the cranial measurements of a specimen of the Pleistocene horse *Equus scotti* Gidley (1900) discovered at the type locality in the summer of 1936 by a field party from the West Texas State Teachers College. The skeleton is complete except for one hind leg and the caudal vertebrae. Although the osteology of this species is well known, the measurements here recorded, which follow the system proposed by Osborn (1912), may aid in the establishment of typical characters or in the delimitation of possible variations within the species. Views of the skull are shown in text figures 1–3.

The articulated skeleton was found in a quarry on the Cross MacDaniels ranch near Rock Creek, Briscoe County, Texas, 1,383.3 feet from the east line and 4,119.6 feet from the south line of sec. 213, Block G. & M., Denison & Southeastern Railroad Company survey, at an altitude of 3,221 feet above sea level. This quarry has yielded several other complete or nearly complete skeletons, including the type. They were found in fine consolidated white cross-bedded sand containing granules of calcium carbonate and lying about 30 inches below a 1-inch continuous horizontal stratum of bluish-green clay, which underlies several feet of compact, semi-consolidated gray sand showing no signs of cross-bedding. This bed is overlain by a rather tough layer of green shale, which forms the surface. Gidley (1903) refers to the deposits as the Rock Creek beds, which he considers of fluvial origin and equivalent to the lower Pleistocene Sheridan formation.

Craniometric measurements

	mm.
Vertex length (from median incisive border to middle of occipital crest).	608
Basilar length (from median incisive border to anterior edge of foramen magnum)	549
Frontal width (at posterior borders of orbits)	193
Cephalic index (frontal width ×100 divided by basilar length)	35.1
Facial length (from median incisive border to middle of line connecting posterior border of orbits)	397
Facio-cephalic index (frontal length ×100 divided by basilar length)	72.3
Cranial length (from middle of line connecting posterior borders of orbits to middle of occipital crest).	224
Cranio-cephalic index (cranial length ×100 divided by basilar length)	40.8
Palatal angle line (vertical distance from middle of posterior border of palate to a line connecting median incisive border and foramen magnum)	18
Palato-cranial angle (angle between the basicranial line, taken outside, and basifacial line)	19°
Occiput height (length of perpendicular from middle of occipital crest to base of mandible)	320
Orbital index (vertical diameter of orbit ×100 divided by horizontal diameter)	76.3
Frank's vomer index (distance from posterior border of palate to middle of posterior edge of vomer ×100 divided by distance from same point on vomer to anterior edge of foramen magnum)	52.1
Convexity of fronto-nasal suture (distance from posterior end of internasal suture to middle of line connecting two most posterior points of fronto-nasal suture)	26
Diastema length (I^3-P^2)	100
Muzzle width (at posterior alveolar borders of I^3)	78
Molar-premolar series total length (upper) P^2-M^3	191
Dental index (molar-premolar series total length, upper, ×100 divided by basilar length)	34.7
Molar index (transverse diameter of M^2×100 divided by molar-premolar series total length)	1.43

Lower jaws	mm.
Height of horizontal ramus at posterior border of M_3	131
Height of horizontal ramus between P_4 and M_1	100
Height of horizontal ramus between P_2 and P_3	93
Length of mandible	485
Height of mandible	255
Width of incisive portion	72
Length of series of lower cheek teeth	186
Length of diastema	98

Dental measurements, lower, in millimeters

	P_2	P_3	P_4	M_1	M_2	M_3
Anteroposterior diameter	34	30	32	30	31	30
Transverse diameter	18	18	16	16	16	14

Dental measurements, upper, in millimeters

	P^2	P^3	P^4	M^1	M^2	M^3
Anteroposterior diameter	40	32	31	29	30	27
Transverse diameter	30	31	29	29	28	21

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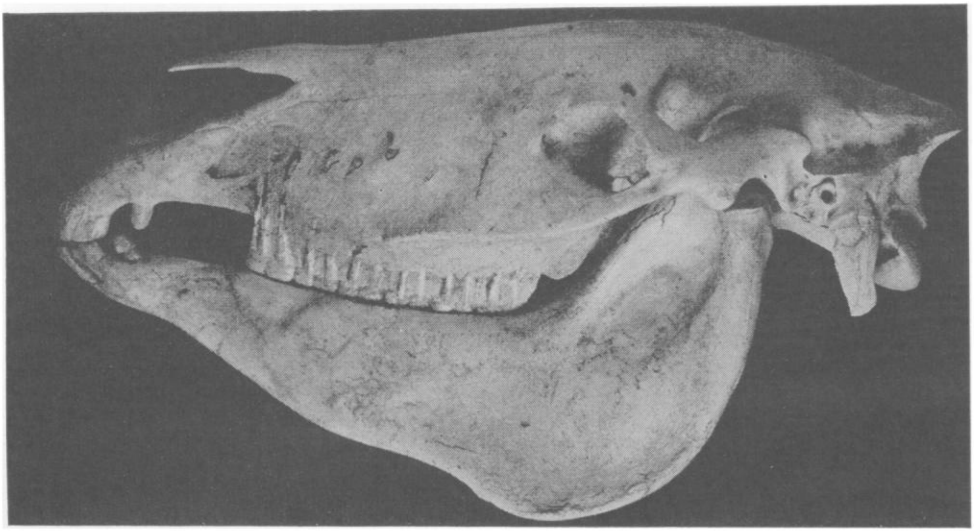

FIG. 1—*Equus scotti* Gidley, side view of skull with mandibles, ×1/5.

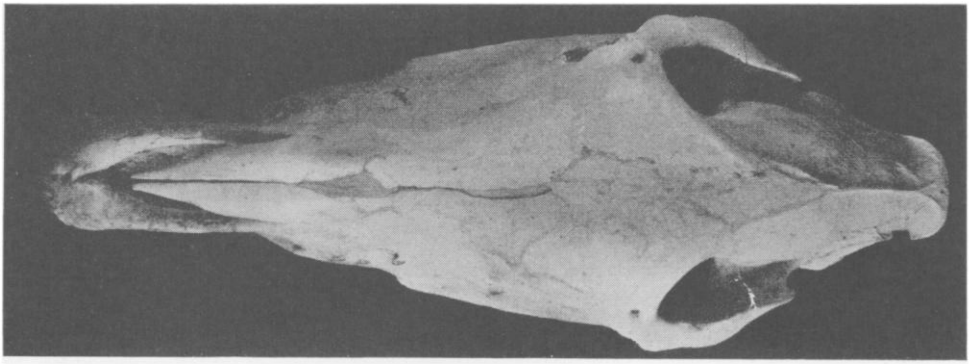

FIG. 2—*Equus scotti* Gidley, dorsal view of skull, ×1/5.

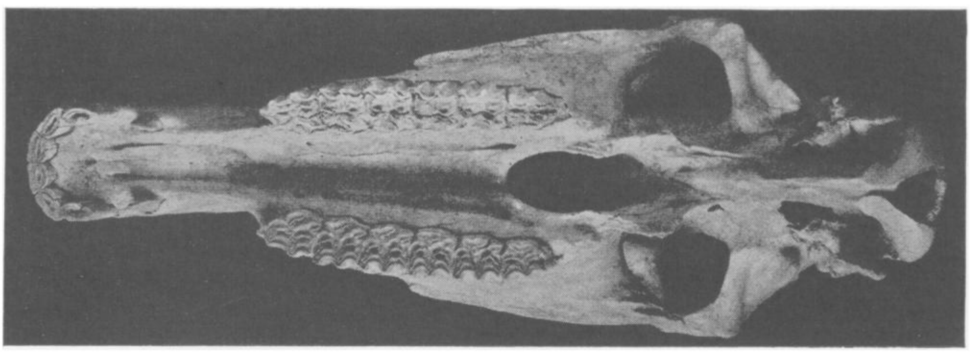

FIG. 3—*Equus scotti* Gidley, ventral view of skull, ×1/5.