GASTROLITHS

In a recent article entitled 'Gastroliths'[1] Dr. G. R. Wieland described some highly polished quartz pebbles, that I had shown to him, stating that they had been obtained in Colorado. This is an error. The pebbles came from the same locality as those obtained by him from Mr. Speers.[2] They were found in the Jurassic or Morrison formation of Montana near the Big Horn Mountains and were near, but not associated with, stegosauroid dinosaur bones. It is noteworthy that some of these jasper pebbles were dug from the clay in this polished condition, showing conclusively that they had been polished either before or during deposition. Others had been uncovered by erosion. Associated with the polished stones were many of less brilliant colors that were unpolished.

Mr. R. P. Whitfield informs me that he has seen quartz pebbles as highly polished as these at Spirit or Devil's Lake near Baraboo, Wis., which had been polished by the action of the wind. However, in a collection of wind-polished stones from New Jersey, preserved in the American Museum, all show faces and parallel angles that have been determined by the direction of the wind and position of the pebbles at different times. Some of these specimens are highly polished, but in no case showing the luster of the Montana specimens.

In the contents of chickens' gizzards I have found that pieces of glass subjected to its action for some time invariably have the edges rounded, while the faces are etched, entirely lacking the former polish. On the other hand, hard quartz pebbles found within the body cavity of a Moa show polish and considerable luster.

The unusually high polish of the Montana pebbles does not seem satisfactorily explained, either by the action of the wind or pressure of the clays. But, notwithstanding their proximity to scattered bones, there does not seem sufficient evidence to assume that these stones had been swallowed by dinosaurs as were the stomach stones of Plesiosaurs.[3] There is, however, an example nearly as well established for the herbivorous dinosaur Claosaurus of the Laramie formation.

In 1900, while collecting fossils in Weston County, Wyoming, which is a continuation of the Converse County beds, I found a Claosaur skeleton imbedded in a hard concretionary sandstone. In chipping off the surplus stone three rounded well-worn pebbles were found near the fore legs, embedded in the same matrix. These specimens were preserved and the occurrence made note of at once, for similar stones had not been seen anywhere in the deposit. These pebbles are rounded and vary in size, the largest measuring nearly three inches across. They resemble those found with plesiosaur remains and are polished to about the same degree.

It would be interesting to know what per cent. of acid is contained in the stomach of such birds as the Ostrich and Rhea.

Barnum Brown
American Museum of Natural History,
February 1, 1907

[1] Science, N. S., Vol. XXV., No. 628, pp. 66–67, January 11, 1907.

[2] *Ibid.*, N. S., Vol. XXIII., No. 595, pp. 819–821, May 25, 1906.

[3] *Ibid.*, N. S., Vol. XIX., No. 501, pp. 184–185, August 5, 1904.

SPECIAL ARTICLES

RECONNOISANCE OF A RECENTLY DISCOVERED QUATERNARY CAVE DEPOSIT NEAR AUBURN, CALIFORNIA

It was recently my good fortune to be sent by Professor J. C. Merriam to investigate a cave which had been brought to his notice through Dr. J. C. Hawver, of Auburn, California. Professor Merriam has since visited the cave and has kindly turned his notes over to me. In recognition of Dr. Hawver's vigorous prosecution of the work of cave exploration in this region we have named the cavern Hawver Cave in his honor.

Hawver Cave is situated about three miles due east of Auburn, Eldorado County, California. It is in one of several lenses of limestone in the Calaveras formation of that region. The trend of the lenses is north and south and the fissures in the limestone extend in the same direction. The entrance of the cave is on the top of the knoll a little south

of the Middle Fork of the American River. Its elevation above sea level is 1,300 feet and its elevation above the river at this place is about 650 to 700 feet.

A perpendicular crevice gives access to the first part of the cave. The opening is partly filled with angular limestone fragments and red dirt to within about eight feet of the top. From the entrance the slopes extend down in a southerly direction for approximately forty feet. At this point two irregular, narrow openings give access to a well-like grotto twelve feet deep. From this grotto a small circular hole leads to the main portion of the cave. To reach this a rope is fastened in the grotto and lowered through the circular opening to a depth of twenty-two feet. The rope drops vertically, hanging free from the walls of the inner cave, and the lower end is immediately over a small subterranean lake. Near the end of the rope is a narrow tunnel about a foot above the water. This extends south for about six or eight feet, where another pool is encountered. Here a raft, consisting of an air mattress, is called into service, and paddling across the water for thirty feet a landing can be made on a mud-covered bank. From the south edge of the water and running in a southerly direction for approximately fifty feet is a tortuous series of narrow passages leading into grottos of varying dimensions; some of them are very large. These grottos and narrow passageways appear to be the extensions of an open fissure that has been widened by water and weathering. At one time the fissure was loosely filled with pieces of limestone and dirt, and the water running through has cemented it with a deposit of lime, forming a breccia which covers most of the irregularities of the fissure walls, and fills in small openings and grottos where the conditions are favorable. The distribution of the breccia indicates that the former filling of the present open spaces has sunk or been washed to a lower level now covered by water.

The cave is evidently at present in an active stage of growth, as there is a perceptible current in the water. The work of carving its walls and openings by taking the lime in solution and carrying it away is now going on. It differs in this respect from the Shasta caves which have been explored, in that the latter have attained their growth and the Quaternary openings have been sealed many years. The surface conditions above Hawver Cave by sinks and numerous small openings show where the old fissure was.

Since the recent removal from the cave of the fossil specimens now in the University Museum the water has risen to such a height that it is impossible to enter the grottos containing the bones. This rise in the water level has taken place since the last rains and demonstrates that the presence of pools in the cave is due to seepage and rivulets from the high ground above. It also shows how the fissure contents have been loosened by leaching at times of high water and allowed to sink to a lower level.

Fossil remains are numerous, considering the small space they occupy. The bones are imbedded in the breccia lining the walls and filling the small openings. High up on the roof blocks of stone have lodged and choked the fissure, and tumbled among the stones are limb bones and other skeletal elements of different animals, wedged in and cemented by a film of stalagmite. The bones are in a perfect state of preservation. In some specimens infiltration has taken place.

The remains have every appearance of being gradually accumulated in the fissure by falling and washing in from the surface, probably in part through the agency of rivulets. As has been noted from investigation in some of our northern caves, the animals probably used hollows or large crevices in the rocks as retreats and places in which to eat their prey. Numerous bones were accumulated in this manner, and were in an excellent situation to be entombed in the crevices of the limestone.

But few bones have been removed so far, though enough are known to indicate the age of the deposit and give promise of a rich fauna.

The most conspicuous of the remains are some excellently preserved *Megalonyx* bones; these consist of vertebræ, limb bones and a tooth. Also the remains of a cougar (*Felis hippolestes* ?) and of a horse (probably *Equus*

occidentalis). Many rodent remains are present, notably those of *Aplodontia*.

The fauna, so far as known, differs from that of the Shasta caves in the absence of the peculiar goats, *Euceratherium* and *Preptoceras*, and of the deer. As far as our knowledge goes at present, the split bones so numerous in the northern caverns are relatively scarce in Hawver Cave. A fuller collection will throw more light on this point, and will give us a better knowledge of the relation of this fauna to that of other caves in this state.

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CURRENT NOTES ON LAND FORMS

CHANGES OF LEVEL IN YAKUTAT BAY

The deformed shorelines of the Yakutat Bay region in Alaska as described by R. S. Tarr and L. Martin in 'Recent Changes of Level in the Yakutat Bay Region' (*Bull. Geol. Soc. Amer.*, XVII., 1906, 29–64) reveal recent and extraordinarily rapid and great changes in land level. The region is one whose general features were already known through the studies of Russell (1890) and Gilbert (1899), both of whom include mention of the precipitous shores in their general descriptions.

In September, 1899, three months after the Harriman expedition, of which Gilbert was a member, a series of violent earthquakes occurred in Alaska. The shocks are now found to have been associated with displacements that produced uplifts of from seven to ten feet on the southeast and of from forty to forty-seven feet on the northwest side of Yakutat Bay. The uplifts seem to have occurred within a little over two weeks and mainly on a single day, September 10, 1899. There were movements in other parts of the region besides Yakutat Bay, but to a less extent, and in some cases there was depression instead of elevation.

The physiographic effects of uplift are clearly preserved in the form of elevated beaches with fans and deltas of moderate size in bays, and of elevated narrow rock benches with sea caves and chasms cut in the headlands. Several new reefs and islands have appeared in consequence of the change of level. In some localities the elevated beaches are as clearly preserved as if they were merely exposed at low tide; elsewhere they have been partly dissected, the degree of preservation varying with height above present tide, position with respect to drainage from the land, and effectiveness of present wave attack. At almost every stream mouth there is an elevated fan or delta, its front nipped away by wave action after uplift and its top dissected by the now intrenched stream. In some cases the frontal nipping has been checked by new deltas built seaward from the new shoreline. The amount of land gained from the sea is very small in consequence of the former steep submarine slope imposed by previous glacial erosion upon mountain sides that may have been initially steep from faulting. It is evident that even the pre-earthquake stage of shore-line development was very little advanced, so small was the modification of land form along the line of sea action: the post-earthquake development is perceptible only on loose material; the rock slopes do not yet appear to be cut at the new water level.

I. B.

THE TIAN SHAN PLATEAU

Recent explorations of the Tian Shan Mountains of north-central Asia have shown that a considerable part of their area consists of highlands of moderate relief, locally known as Syrt, at an altitude of 3,000 or 4,000 meters, above which various mountains rise and beneath which numerous valleys are deeply entrenched. The rocks of the highland are for the most part granites and other crystallines or deformed Paleozoic strata, across which the highland surface passes indifferently; but Tertiary deposits occur here and there, and the higher areas bear signs of glaciation. One of the first explorers to give an appreciative account of the plateau-like highlands was M. Friederichsen, now of Göttingen, who in 1902 accompanied Saposhnikof, botanist of Tomsk, into the district west of Khan Tengri, the great dominating summit