surmised, take the trouble to look up the original reference (Linnæus, "Syst. Nat.," 10th ed., I., p. 657). Having *had* confidence in the above authorities I copied their blunder, with the best intentions. So much for my error.

I shall adopt (but not "with pleasure") Jäger's name *Bohadschia*. I have for some time been aware that *Microthele* probably has precedence over *Actinopyga* Bronn (for the genus erroneously called *Mülleria*), but I hesitate to accept it until the identity of Brandt's species is settled beyond peradventure.

Apropos the passing of *Holothuria*, for the old and well-known genus of sea-cucumbers, an amusing yet serious situation presents itself. Naturally, if, as Dr. Gill points out, *Holothuria* is really a Portugese man-of-war, we can no longer speak of sea-cucumbers as "holothurians," nor of the class as *Holothurioidea*. The word "holothurian" has been, in its limited field, as useful as the more familiar "mammal." And which of the several synonyms should succeed *Holothurioidea*?

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SPECIAL ARTICLES

The Occurrence of Middle Tertiary Mammal-bearing Beds in Northwestern Nevada

In the summer of 1905 the writer received from Mr. Robert L. Fulton, of Alameda, California, several fragmentary bones and teeth of Miocene mammals, said to have been obtained at Virgin Valley, in northwestern Nevada. Subsequently arrangements were made to visit the locality in company with Professor John A. Reid, of the University of Nevada. Professor Reid very kindly made inquiry as to the location of the beds, but was himself unable to visit the region. In June, 1906, the writer in company with Mr. Felix T. Smith, of the University of California, visited Virgin Valley for the purpose of making a preliminary examination of the field. In reaching the valley we were kindly assisted by the employees of the Miller & Lux Company, and in locating the most fossiliferous exposures we were much indebted to Mr. T. H. McGhee, whose son, Mr. Edward McGhee, was the first person known to have discovered fossil bones in that region.

Virgin Valley is situated in northwestern Nevada, about 15 miles south of the Oregon line and 40 miles from the California line. Virgin Creek, which drains the valley, is a tributary of Thousand Creek, emptying into Thousand Lake, close to the northern border of Nevada. The region about Virgin Valley is semi-arid and is practically treeless. Though no extensive search has been made through the literature, I am not aware that this region has ever been visited by any geological party. A number of explorers have evidently passed near it to the north and to the south.

The valley of Virgin Creek is a basin with a north and south trend, the fossil beds being situated in a trough formed by an older series. The older formation consists largely of tuffs, ashes, and rhyolitic lavas. Superficially it resembles a part of the Clarno Eocene series of the John Day region to the north. On the east side of the syncline, at Thousand Creek Hill, a fine section of these beds is exposed. Some of the tuffs in the upper part of the series are exceedingly coarse, and pieces of pumice in them are in many instances several inches in diameter. The lower portion of this series was not examined, but the materials seem to be finer toward the base of the section. Beds superficially similar to those on Thousand Creek Hill cut off the southern end of Virgin Valley on the other side of the syncline, beyond the Virgin Ranch. At this point they dip back toward the Thousand Creek Hill to the northeast.

The mammal-bearing Tertiary formation, which is here tentatively designated as the Virgin Valley beds, rests in the basin formed by the older tuffs. Where the lower portion of this formation rests upon the older beds it has been somewhat disturbed, but the amount of disturbance appears, at least in some cases, to be less than that shown by the older series. The inclination of the Virgin Valley beds on the eastern side of the syncline may be largely due to the development of an extensive fault

which forms Thousand Creek Hill, and presents a steep escarpment to the east.

The thickness of the Virgin Valley beds is evidently between one thousand and two thousand feet. The larger part of the formation is composed of volcanic ash or tuff showing a variable amount of induration. Characteristic bad land structure has been developed in many places. The formation may be divided somewhat arbitrarily into upper, middle and lower divisions. The lower beds are somewhat harder than the others, and where bad land structure occurs in them very steep faces are frequently produced. These beds show strong contrasts of coloration, varying from white to green or bright red. The middle beds are generally brownish or gray, and weather in gently rounded knolls. The upper beds are usually softer than the others and consist of cream-colored ash.

Mammal remains are quite common in portions of the upper beds, and at a horizon which is apparently in the lower division, though not in its lowest portion. Only a very few fragments of bones were found on the middle division, but plant remains are very abundant at this horizon. Large logs of beautifully petrified wood are present in abundance, and near the middle of this division stems and leaves have accumulated in sufficient quantity to form a thin lignitic deposit.

Judging from the character and occurrence of the fossil remains, large portions of the upper and lower divisions of the formation are of æolian origin, or have formed in shallow, shifting lakes comparable to existing lakes only a few feet in depth, such as are not uncommon in the eastern Oregon region at the present time. A part of the middle division, particularly that portion containing the lignitic deposit, has evidently formed in or about a body of water.

The mammalian remains obtained from the lower horizon include a type near *Chalicotherium* or *Moropus,* two types of horses, two or more cameloid types, a canid and a number of other forms. *Chalicotherium* is represented by a number of characteristic bones, including the peculiar phalangeal elements. Of the horses one is a form with short-crowned molar teeth resembling those of the Miocene *Hypohippus.* The other has short-hypsodont molars and is evidently in, or close to, the Miocene genus *Merychippus.* Of the camels one species is represented by limb bones indicating an animal of considerable size, and evidently of the *Procamelus* type. The canid is represented by a second lower molar apparently differing from any type thus far described from the Tertiaries of the Pacific Coast region.

The fauna of the upper beds includes a mastodon, a horse, two camels, a large cat and fragmentary remains probably representing a rhinoceros. The mastodon is a species of considerable size, and is evidently not older than the stage of the Mascall Miocene of the John Day region. One of the camels is represented by a metapodial about as large as that of *Alticamelus* of the lower Loup Fork. The cat is known only from a second phalanx indicating a large form with powerful extremities.

Such paleontological material as is present indicates that the upper division of the Virgin Valley beds is probably of Miocene age and not older than the stage of the Mascall Miocene of the John Day region. The fauna of the lower horizon, so far as known, is also evidently Miocene, though it may represent a slightly different phase.

The fauna of the Virgin Valley beds, particularly of the upper division, appears in a general way to represent the same period as the fauna of the ash and tuff formations in Nevada, which have commonly been recognized as corresponding to the Truckee Miocene. If such is actually the case, there will apparently be little reason for correlation of the Truckee with the John Day, as has commonly been done, since the Virgin Valley beds are near the age of the Mascall beds of Oregon, and the John Day is separated from the Mascall Miocene by the Columbia Lava formation, as also by a considerable unconformity below the Columbia Lava.

As far as I am aware, the beds of the Virgin Valley region offer more material

for the study of extinct mammalian faunas than has yet been discovered elsewhere in Nevada. Situated as they are between the typical localities of the Tertiary formations of eastern Oregon and the areas of Truckee Miocene in Nevada, they will probably be the key to the correlation of these formations. The examination of the beds made thus far has necessarily been exceedingly superficial, but it is hoped that the continuation of this work during the next season will put us in a position to make a satisfactory determination of the relative ages of the Oregon and Nevada Tertiary formations.

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Physiographic Changes Bearing on the Faunal Relationships of the Russian and Sacramento Rivers, California

For some time biologists in this state have noted the close relationship between the fauna of the Russian River and that of the Sacramento, in forms that do not migrate through salt water. In a recent trip through Lake County very clear evidence was found that the waters of the Scott's Creek now flowing into Clear Lake and thence into the Sacramento, formerly flowed into the Russian River. Clear Lake is a sheet of water some twenty miles in length and lying at an elevation of about thirteen hundred feet in the middle of Lake County. Scott's Creek rises in the mountains to the westward and after flowing to within two miles of Clear Lake turns to the northwest, cutting a gorge through the mountains.

On going *down* this valley one is confronted by the startling physiographic fact that it bifurcates into two valleys without change of grade. Such a division is not unusual on the flat surface of a low-grade delta, but it challenges investigation when encountered in a mountain gorge with hills rising fully a thousand feet on both sides. The valley to the left has practically a level floor and is occupied by the narrow and rather deep Blue Lakes. Three miles from where it leaves Scott's Creek, without any narrowing it terminates abruptly against a transverse ridge about one hundred and sixty feet high. Beyond this ridge the valley is occupied by Cold Creek, which empties into the Russian River.

Returning to the point of bifurcation of Scott's Creek the gorge to the right turns eastward and empties into the northern end of Clear Lake.

Climbing the hills on either side of Blue Lakes the valley in which they lie is seen to be continuous in slope and outline with that of the upper portion of Scott's Creek and of Cold Creek except for the low transverse ridge already mentioned and which evidently is the dam that made Blue Lakes.

On examination this ridge is clearly a comparatively recent landslide. It has the characteristic hummocky, uneven surface and still shows two or three ponds not yet filled nor drained. The slide came from the southwest slope of the main valley and is approximately a mile in length, starting from an elevation of fifteen hundred feet (aneroid) above the Blue Lakes. The valley is here about an eighth of a mile in width, and the momentum of the slide carried it across the valley and somewhat up the opposite slope. At this point, which is crossed by the stage road to Ukiah, the contrast in color of soil of the slide and of the eastern valley slope is very marked.

When the slide occurred the waters of Scott's Creek were evidently backed up for some ten miles, forming a lake, narrow in the gorge and widening out in the more open valley above. The waters of this new lake rose until they overflowed a low divide separating a tributary from the head of a small tributary of Clear Lake. The outlet thus determined was lowered by erosion and is now the main channel of Scott's Creek. The base level for this channel was determined by Clear Lake and the lake in Scott's Valley was soon filled by sediment making a rich alluvial plain with a maximum width of two miles. In a well sunk in the center of this plain tules were found at a depth of about seventy feet below the present surface. The portion of the old channel below the tributary through which