his sons, announced recently in a note read at the French Institute, the substance of which is contained in a letter just received from him, was made only a few days before the declaration of war last August. In fact, it was on July 20, 1914, exactly two years after the discovery of Tuc d'Audoubert, that he and his three sons descended by an opening until then unknown into a superb cavern, which in their honor he has named *Caverne des Trois Frères*. It is about half way between Tuc d'Audoubert and the cave of Anlène, in other words about a quarter of a mile from each. Count Begouen believes that the three caverns are connected by corridors; proofs of a conection between two are already in hand.

The exploration was not only difficult, but also dangerous (there are galleries into which he has not yet been able to penetrate), but one is well paid for the effort because of the beauty and elevation of the ceilings as well as "the numerous prehistoric remains encountered there." On the floor were many bones, flint implements and objects bearing man's handiwork.

The results of their first visits were of such a nature as to foretell an abundant harvest when the work shall have been resumed. Upon a bone fragment there was an excellent engraving of a fish. But the chief display of art was on the walls, especially of the terminal gallery, where more than two hundred admirably engraved figures of animals are to be seen. The following species have already been identified: Mammoth, rhinoceros (the first found in the caverns of the Pyrenees), bear, lion, wolf, deer, reindeer, wild goat, horse, bison, chamois, eel and bird. There are also anthropomorphic figures including a curious female type drawn in black; it seems to be walking almost on all fours with the head surmounted by a reindeer horn. It might represent a human figure wearing a mask, or perhaps a figure with mixed attributes; if the latter, then we have a new note in paleolithic art, for until now that art has revealed no representations of mythologic creatures.

Most of the mural art in the *Caverne des Trois Frères* is admirably done; a small panel with reindeer at rest evidently enjoying themselves is "like a page from an album." From the viewpoint of the engravings this cavern is "certainly the richest and the most beautiful thus far known." In addition to the animal and anthropomorphic figures, Count Begouen noted lines, spots of red or black, and red claviform signs, presumably representing clubs.

War was declared before excavations could be begun. With two of the "trois frères" at the front since then and the youngest having recently joined them there, it can readily be understood why Count Begouen does not wish to return to the cavern so aptly named until he can do so accompanied by his three boys after the war is over. Let us hope that he may have to wait neither long nor in vain.

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SOME EARTHQUAKE PHENOMENA NOTED IN PANAMA

IN October, 1913, the writer was asked by President Porras of Panama to undertake some investigation into the causes of the earthquakes which, during that month, were felt almost daily in the Azuero peninsula which forms the south central part of the republic.

In the course of this investigation two well-recognized geological principles took on a new and impressive significance for the writer, and a vividness that he had never before been able to clothe them with. These principles are the relation of faulting and fracture to earthquakes, and the elasticity of the earth as expressed in earth-waves.

Simultaneously with the first and heaviest shock the cable line from Panama up the west coast to California broke at a point where it passes over the submarine escarpment from the continental shelf at about 60 fathoms to the ocean depths at from 700 to 1,000 fathoms. The distance on the chart from the 60-fathom sounding to the 784-fathom sounding is less than two miles. It is not known, however, whether the slope between these two points is

uniform or locally abrupt. Not only did the cable break, but the repair boat reported that half a mile of it had been buried in debris on the bottom and had to be abandoned and a new piece spliced in.

It is said that the cable was broken in almost the same place by an earthquake between the years 1882 and 1883.

To the writer the only adequate explanation of the breaking of the cable and the burying of half a mile of it is that movement occurred along an old fault escarpment, or fault zone, which marks the boundary between the continental shelf and the deep ocean basin, and that this movement was great enough to cause the earthquake, resulting in a submarine landslide. It is not known whether the fault displacement broke the cable or whether the submarine landslide caused by the jar of the faulting broke it; of course the jar of the fault movement was the earthquake.

Nearly all of the later shocks felt were accompanied by peculiar underground sounds which, at times, seemed to begin to the eastward of the observer and to die away in 5 or 10 seconds to the westward of him. The sound was not unlike the dull boom made by the fracture of ice on large lakes, due to shrinkage, when the weather has suddenly become extremely cold. The noise of these ice fractures may begin far to the right of an observer and die away in the distance, in a few seconds, to the left of him. After listening, several times, to the underground sounds that accompanied shocks, the writer became convinced that they were due to the formation of small shears or strain-relieving cracks in the rocks, formed perhaps considerably below the surface. A search for such cracks was unsuccessful, due either to the sparsity of rock exposures or to the fact that cracks might not be distinguishable from ordinary jointing, or that they might be parallel, or nearly parallel, to the surface and might not outcrop in the vicinity at all. It is thought that the rock strains would be relieved by many very small fractures along a strained zone rather than by one large break, and the differential movement along each small fracture might be extremely small, possibly measurable say in tenths of an inch.

The breaking of the cable and the burying of a part of it, together with the underground sounds heard several times, as far as the writer can see admit of no other adequate explanation than that herein ascribed to them.

The other geological principle connected with these earthquakes was that of the elasticity of the earth's crust. The writer was on the top of a steep conical mountain peak which stood about 2,000 feet above the surrounding country, when a heavy quake came, causing the mountain to behave like a stiff jelly. One felt as though the mountain were swaying through an arc of several inches. Making ample deductions for the tendency of the senses to exaggerate such an unusual phenomena, it is thought that the swaying motion in a horizontal plane was actually about three quarters of an inch. It was one of the most impressive demonstrations of the elasticity of solid rock, of the somewhat jelly-like motion that can be imparted to a "rock-ribbed" mountain, that one could well imagine. With the motion a dull, heavy underground rending sound began on the northeasterly to northerly side of the mountain and died away in the distance on the other side, being audible for say 20 to 25 seconds.

These underground sounds had a most terrifying effect on the inhabitants, who believed they were about to be overwhelmed by some volcanic catastrophe. The investigation was very successful in assuring them that these dreaded sounds were quite harmless and were not due to any subterranean fires, and that the near-by mountains were not going to turn into volcanoes and overwhelm them as they feared. In spite of this soothing information, however, a few of the natives were unjust enough to criticize the writer for not stopping the quakes as quickly as they wished. Such is "man's inhumanity to man."

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THE THOMAS SAY FOUNDATION

An organization, with the above name, was formed under the auspices of the Entomolog-