fracture surfaces. The area of deformation is located in a region where faulting is rather common so that the fracturing is not out of the ordinary. The unusual feature, however, is the absence now of any displacement along the lines of fracture.

The formations involved in the deformation are the Glen Dean limestone and Tar Springs sandstone of the Chester series of Mississippian age. The general dip of the rocks in the surrounding territory is about one degree in a northward direction. The Glen Dean limestone dips under about one fourth mile down stream from this locality. In the area of disturbance the rocks are folded into a small anticline, the trend of whose axis is at right angles to the general dip direction. The amount of elevation in the fold is small, approximately twenty feet, being sufficient to bring the Glen Dean limestone again to the surface in the bed of the creek. The fold is asymmetrical with the steeper dip, about three or four degrees, on the south and a lesser dip, about two degrees, on the north flank. The zone of deformation is parallel to the axis of the fold and is on the steeper, southern flank.

In the zone of deformation, which is about twenty feet in width, the Tar Springs sandstone has been fractured along a number of surfaces which have dips ranging from seventy degrees to vertical. Some are inclined toward the south and others toward the north, but the strike of all of them is essentially parallel to the axis of the fold. Some of the inclined breaks intersect and even at the points of intersection there is no offsetting of the breaks or of the beds. Some of the breaks are closely spaced, two to four inches apart, while others are several feet apart. Almost all of them exhibit effects of movement, the fracture surfaces being grooved and polished. The walls of many of the surfaces of movement are not now in contact, some of the breaks being open as much as an inch. How much movement there may have been along these lines of fracture it is impossible to say.

The following explanation is offered for the phenomenon. At the time of folding of the rocks the south flank of the anticline broke along this zone, the pressure being sufficient to cause enough movement to polish and groove the sandstone. With a decrease in the folding pressure the dislocated beds moved back to their original positions so that, while the effects of pressure and movement are clearly preserved, the beds show no dislocation or at the most only a very little. An alternate hypothesis is that the beds may have been in movement up and down along the fracture surfaces several times during the period of deformation. Due to the weight of overlying sediments and the inherent elasticity of the folded rocks, they tended to return to a more flattened attitude during such times as the deformative force was diminished. After deformation, the diminished compressive force allowed the beds to return to the relative positions they occupied before breaking. Although oscillatory movements along faults and partial returns to the original positions are known to have occurred, the writer knows of no other instance where the amount of recovery has so nearly equalled the amount of deformation.

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## AN UNUSUAL RAINBOW

A REMARKABLY brilliant rainbow appeared to the northeast of Tucson, after a hard shower about 4 P. M. on February 13, 1931. This rainbow was out of the ordinary in that a repetition of the spectrum showing first, second, and third order colors in the same sequence occurred on the inside of the rainbow, as well as a fainter secondary reversed rainbow about 10 or 15 degrees outside of the primary arc. The brilliance of the rays of the sun in our southwest is no doubt responsible for the observance of this unusual phenomenon.

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# SCIENTIFIC BOOKS

*Thomas Say, Early American Naturalist.* By HARRY B. WEISS and GRACE M. ZIEGLER. Foreword by L. O. Howard. Springfield, Illinois, Chas. C. Thomas. 260 pp.

SAY died in 1834, so that nearly a hundred years have been allowed to pass before the publication of a really satisfactory biography. Every zoologist and more particularly every entomologist and conchologist, has been familiar with the name of Say, with a more or less vague understanding that he was one of the founders of the science in America. The eccentric naturalist, in Fenimore Cooper's "Prairie," illustrates the once prevalent attitude toward the zoological explorer. The present book describes Say's life in the environment of his time and we may well marvel at his steadfast zeal, his ability in overcoming obstacles, the excellence and volume of his work. Aided by his friend and patron, William Maclure, he managed to accumulate a good library of zoological works, especially those in which American animals were described

by European authors. He corresponded with zoologists on both sides of the Atlantic and made every possible effort to avoid the publication of synonyms. He visited Colorado with Long's Expedition, and also carried on explorations in the northwest, as a member of the expedition of 1823 to "the source of St. Peter's River, Lake Winnepeek, Lake of the Woods, etc., etc." With Maclure he traveled to Florida (1817–18) and Mexico (1828). As the result of all these activities he was enabled to describe considerably over a thousand new species of American beetles, over four hundred insects of other orders, a large proportion of our common shells, as well as crustaceans, birds, mammals, reptiles and a certain number of fossils. His work has stood the test of time, and his species are for the most part currently recognized. Mrs. Say, who survived until 1886, drew the figures on sixty-six plates to illustrate Say's Conchology, and the figures were colored by hand with the aid of some pupils.

When Robert Owen established his socialistic community at New Harmony, Indiana, Maclure was drawn into the undertaking, believing that he could make the place the center and fount of American education. Say accordingly left Philadelphia and became a resident of New Harmony. We are told how disputes arose and the experiment ended in failure, as perhaps ought to have been foreseen from the beginning. But Owen's sons remained to do distinguished work in America and in a large sense the idealism of the movement was not wasted, but has continued to bear fruit down to the present time. Even the lessons derived from its failure have been valuable.

Say's shells are for the most part in the Academy of Natural Sciences at Philadelphia, but of his insects it seems they have only one specimen, the type of the famous White Mountain butterfly. The insects were destroyed by dermestids, and although it is not so stated, must have been thrown away after Dr. T. W. Harris returned the ruined collection to the Academy. It was not understood at the time that even the fragments would have been of great value to posterity. Fortunately the species were so well described that there is usually little dispute concerning their identity. It was however a defect in Say's work that he was accustomed to cite localities very vaguely. The book represents a very large amount of work and is full of interest. Every student of American zoology should read it, and then Dall's "Life of Baird," and thus learn how the science was developed in this country during the nineteenth century. It is a story of enthusiastic workers overcoming difficulties which seem terrific to us in these relatively easy days. When we are inclined to complain of the obstacles in our way, it is good discipline to turn to the life of such a man as Say, and see how he conquered what seemed to be the iron hand of fate.

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# SCIENTIFIC APPARATUS AND LABORATORY METHODS

## A NEW SINGING TUBE

LAST April, while making a piece of apparatus from pyrex capillary tubing, I noticed that a piece about 10 cm long and 2 mm inside diameter began to emit a musical note when the bulb which I was blowing on the end reached a volume of approximately 2 cubic centimeters. Recalling that Dr. C. T. Knipp, of the

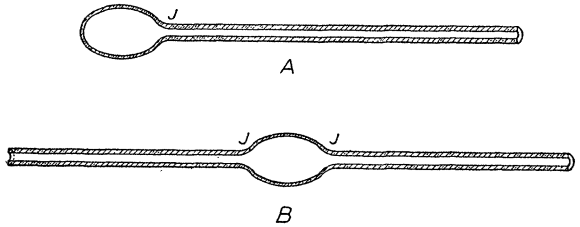


FIG. 1

University of Illinois, had developed a singing tube some ten years ago, I assumed this to be what he had observed.

On running across an account[1] of Professor Knipp's tubes recently, however, I think the difference in the two cases is worthy of notice. His tubes as reported were all substantially of the form of an ordinary mercury trap.[2] It appears that this special form is not necessary: a tube with a bulb on one end and the other end open (*A*, Fig. 1), or with the bulb in the middle and both ends open (*B*, Fig. 1) will sing, with various shapes of bulb. The note emitted appears to depend chiefly on the volume of the bulb and tube, the temperature at the junction (*J*) of bulb with tube, and the diameter of the tube.

The phenomenon has been observed with tubes of various lengths and from 1½ to 4 mm inside diameter; but outside these limits it has not been detected. When the junction of the bulb with the tube is heated to about the temperature of redness the oscillations begin. Heating elsewhere is not effective until this temperature is attained at the junction.

A tube 13 cm long, 2.3 mm inside diameter and having a bulb of 1.8 cubic centimeters (approxi-

[1] *Phys. Rev.*, xii, December, 1918, p. 191.

[2] SCIENCE, April 22, 1921, p. 393.