of the neon by some unknown volatile constituent of the tire tape, since even n-butyl phthalate, whose vapor pressure compares with that of mercury, contains something that prevents neon luminescence when excited electrically.

The phenomenon is quite similar to the well-known luminescence when mercury is shaken in an exhausted tube. If neon is present the luminescence is reddish. The light in a Torricellian vacuum at the head of a mercury column when carried from room to room was observed by Picard in 1675.

These experiments suggested study of the flashes of light observed when crystals are broken, true triboluminescence, characteristic of either minerals or organic compounds, as when two lumps of sugar are rubbed together. If a crystal is piezoelectric, large potential differences are built up by compression. Rochelle salt crystals, strongly piezoelectric, give an orange luminescence when shaken in a tube with 5 cm of neon but no light when shaken in a tube with air, although a flash of light appears in air when the crystal is broken with a hammer. Sugar crystals (rock candy), also piezoelectric, give orange flashes when crushed in 5 cm of neon. Indeed, a large number of substances which do not luminesce on crushing or rubbing in air give a reddish luminescence if shaken with a steel ball in a glass tube containing 5 cm neon. Such are fragments of pyrex glass, galena, Kieselgur (filtercel No. 503), $KClO_3$ crystals, KCl crystals (some samples of which are said to be triboluminescent in air), chitinous Cypridina shells and silk fragments. The reddish luminescence observed in shaking these materials is undoubtedly due to discharges from tribo- or piezo-electricity. However, when crystals of salicylamid, salophen and uranyl nitrate, markedly triboluminescent in air, are shaken in 5 cm neon, in addition to some orange luminescence, which represents electrical discharge in the neon, the bright greenish or colorless sparks of triboluminescence are still apparent. They are not definitely orange or reddish in color.

In triboluminescence of some crystals we therefore have the possibility of light from electrical discharge in the surrounding gas and in addition the excitation of molecules of the crystals themselves. It is noteworthy that salicylamid, salophen and uranyl nitrate are all markedly fluorescent substances whose molecules are excited by ultra-violet light. The luminescence on stripping tapes covered with rubber cement or the separation of various films from surfaces appears to be due entirely to electrical discharge in the surrounding gas.

It is a pleasure to acknowledge the assistance of Mr. Charles Butt in carrying out these experiments.

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CONSUMPTION OF TEOSINTE SEED BY BIRDS IN GUATEMALA

TEOSINTE (*Euchlaena mexicana*), the wild relative of maize, occurs in Guatemala and Mexico often along fence-rows. Kempton and Popenoe[1] suggested birds as a possible factor in the spread of this grass. During a residence in Guatemala for the purpose of studying the maize agriculture of the Indians for the Carnegie Institution of Washington, the writer undertook observations in most of the teosinte localities of the republic with a view to determining what role, if any, birds might play in the distribution of the plant.

A visit was made to the Jutiapa region in southeastern Guatemala in the month of October, 1937. The teosinte seed proved to be unripe at that time, although in other years the month of October had marked the maturity and almost complete scattering of the seed. The prolonged rainy season of 1937 apparently delayed the ripening of the seed, which reached maturity near the end of the following month. During a second visit to Jutiapa made in this month (November), large numbers of birds were observed in the teosinte growths. Many examples were shot and stomach contents noted, whereby it was shown that several species of birds feed upon teosinte seed. A most remarkable fact brought out by these observations is that the birds do not swallow the entire rachis segments, but first remove the horny outer covering which might prove indigestible. The exact manner in which the birds accomplish the extraction of the inner grain was not observed, but local residents claim that at times one can hear the cracking of the outer shell by the birds. All the birds in whose stomachs the seed was found possess powerful beaks.

Specimens collected in the teosinte fields and sent to Washington for the collections of the U. S. National Museum were identified by Dr. Alexander Wetmore as belonging to the following species: *Passerina cyanea,* indigo bunting; *Guiraca caerulea caerulea,* eastern blue grosbeak; *Guiraca caerulea eurhyncha,* large-billed blue grosbeak; *Aimophila ruficauda,* russet-tailed ground sparrow.

The first two species are winter migrants from the United States, and the ground sparrow is native to Guatemala. The large-billed blue grosbeak, if not native to Guatemala, may be a migrant from farther north in Mexico.

Teosinte seed was found in the stomachs of all birds belonging to the first three species above listed. In the specimens of ground sparrow (*Aimophila*) the stomach contents were not identified with certainty and did not appear to be teosinte seed.

During subsequent collecting of teosinte seed in the region of Jacaltenango and San Antonio Huista in northwestern Guatemala in December of the same year,

[1] J. H. Kempton and Wilson Popenoe, *Carnegie Inst. Pub.* No. 483, p. 210, June, 1937.

similar species of birds were observed feeding upon the seed, but here no specimens were collected.

It is to be remarked that close examination of the intestines of the Jutiapa birds showed that digestion of the seed was complete in every instance and that therefore it is unlikely that these birds are a factor in the distribution of teosinte.

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MULL SOIL UNDER SPRUCE

THE development of the mull type of soil in spruce (-fir) woodlands has always been regarded as an unusual phenomenon. As earthworms are regarded as predominant formers of mull soil, and as earthworms prefer a limy soil, the logical place to look for mull soil under spruce would be over limestone deposits. As these occur extensively in Vermont, spruce tracts over limestones were examined in northeastern Vermont, using the *State Geologist Reports* to locate the limestone beds. A handy indicator of such deposits is the white cedar (*Thuya*). In glaciated country the mineral soil of limestone areas is so impregnated with ground limestone that the original deposits do not have to be close to the surface to influence the fauna and flora dependent on or partial to limy soil.

Throughout the region investigated, many spruce stands occur on former pastures, meadows and fields which have been subsequently abandoned and overgrown with spruce. Such agricultural land over limestone usually harbors earthworms, and these may persist in the soil for at least twenty to thirty years after the spruces have occupied the site. Such stands were not included in the investigation, which was limited to such sites as were so extreme as to have been impossible for agriculture. The following two types of sites fall under this head: (1) land too wet for plowing or pasturage, as swamps and seepage areas, (2) land too steep, as ravine sides. Such sites were invariably found to have mull soil (over limestone) except that the mull soil of the swamps was confined to a narrow strip about the edge of the swamp where the land rises from the dead level characteristic of muck swamps formed by lake filling, etc. Earthworm castings and middens were not always visible on the spruce litter, though perforations usually occurred.

The most favorable areas in Vermont were in the counties of Orleans, Caledonia, Washington and Orange. An area in northern New Hampshire (Coos County) was also found to have mull soil in similar favorable sites. Some of these sites were under large spruces and there were large tree stumps about, showing the land had been under woodland for a long period of time.

Thus it is evident that mull soil under spruce stands is not rare if sought for in situations favorable to earthworms.

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GRAPTOLITES FROM HIGHGATE, VERMONT

To one who has some acquaintance with the area lying east of Lake Champlain and comprising the northwestern corner of Vermont and adjacent parts of Canada, it is not surprising to note the interest shown in this region by various geologists and advanced students. Welcome progress has been made in the interpretation of the difficult geology involved.

In view of announcements within the last three or four years of the occurrence of graptolites in certain rocks in Highgate Township, Vermont, it seems pertinent, for purpose of record, to call attention to the previous discovery and report of such fossils in Highgate.

In the summer of 1921 the writer found definite graptolite remains in slate beds in the north wall of the gorge of the Missisquoi River at Highgate Falls. Although graptolites are not infrequent in the Ordovician slates along the lake shore in Highgate, such fossils had not been reported prior to 1921 from the belt of dislocated rocks which makes up most of Highgate Township and which lies between the overthrusted younger Trenton and associated beds near the lake, and older rocks at the east in Franklin Township.

Two of the graptolites found at Highgate Falls were tentatively identified by the writer as *Dictyonema,* probably *flabelliforme,* and *Staurograptus dichotomus,* Emmons. These specimens with others were submitted to Dr. R. Ruedemann without reference to the locality at which they were found. Dr. Ruedemann thought that the specimen referred by the writer to *Dictyonema* probably belonged to that genus; but regarded the one compared with *Staurograptus* as probably a young *Dictyonema,* "flattened out in a vertical instead of a lateral direction."[1] At the time these graptolites were reported their probable significance was not appreciated.

Several years later graptolite fragments were found in the same general belt of rocks in Highgate, "about one mile northwest of Highgate Center, Vt." These fragments were referred to Dr. Ruedemann, who described them as belonging to a new species of *Dictyonema,* which he called *Dictyonema schucherti.*[2] A

[1] Dr. Jacot died on March 24.

[1] Vermont State Geologist, Thirteenth Report, 1921–22, p. 188.

[2] "The Cambrian of the Upper Mississippi Valley," Part 3, *Bull. Pub. Mus. Milwaukee,* Vol. 12, 1933.