bodies that represent the calcareous portion of the oogonia—are often preserved in abundance and are stratigraphically important fossils.

The oldest gyrogonites known are from rocks of Early Devonian age in Podolia (western Ukraine). All Devonian and Mississippian forms are composed of vertical units (*Sycidium*) or dextrally spiraled units (*Trochiliscus*). Post-Mississippian gyrogonites are sinistrally spiraled and, with the one exception of the Pennsylvanian *Paleochara,* consist of five units. By early Mesozoic time, the charophytes were apparently a well-established and standardized group and have undergone relatively little change in the Mesozoic and Cenozoic eras.

Charophyte records in the early Mesozoic are sparse and widely scattered. A few forms have been described from various Triassic and Lower and Middle Jurassic localities, but the oldest abundant gyrogonites in North America are from the Morrison formation of Late Jurassic age of the Rocky Mountain area. Gyrogonites are also common in the Lower Cretaceous rocks (Aptian) of the Gulf Coast and the Rocky Mountain area and in the Lower Cretaceous Bear River formation of southwestern Wyoming. In Europe, charophytes have been described from the Kimmeridgian of northern Germany, the Purbeck of England and Northern Europe, and the Aptian of central Hungary. Charophyta from the nonmarine Late Cretaceous are not well known, but they are again common in nonmarine rocks of the Cenozoic era.

Gyrogonites are abundant in the limestones and calcareous shales of the Salt Wash sandstone and Brushy Basin shale members of the Morrison formation in the Colorado Plateau. They are also abundant in the calcareous beds of the undifferentiated Morrison formation along the eastern flank of the Front Range in Colorado and in outcrop areas in New Mexico, Oklahoma, eastern Wyoming, South Dakota, and central Montana.

The gyrogonites from the Morrison are small, averaging about 450 μ in length, and none has been found enclosed in the utricle characteristic of the Lower Cretaceous family Clavatoraceae. Species occurring in the Brushy Basin shale member and not in the Salt Wash sandstone member are present in the northern and eastern outcrops of undifferentiated Morrison. In central Colorado, eastern Wyoming, and the Black Hills region, thin beds of limestone in the Morrison formation consist largely of broken and entangled vegetative parts of charophytes, but to date it has been impossible to associate these remains with the gyrogonites.

Most of the gyrogonites in the nonmarine Lower Cretaceous formations are enclosed in utricles. These forms belong to the Clavatoraceae and, because of their wide distribution and easily recognized characteristics, are excellent guide fossils. The genera *Clavator* and *Atopochara* attained almost world-wide distribution in Lower Cretaceous time.

The utricle-bearing gyrogonites of the Clavatoraceae are not known from the Lower Cretaceous Bear River formation, or from any formation of Late Cretaceous age. The Bear River charophytes fall readily into three specific categories, each species representing a different genus. Two species are ancient representatives of the modern genera *Tolypella* and *Chara,* and one species belongs to the extinct genus *Aclistochara.*

A monographic treatment of the Mesozoic Charophyta of North America is under preparation.

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Contamination of Photographic Emulsion Caused by Beta-Active Dust

IN the scanning of 16 cm^3 of G-5 emulsion (1 by 3 in. Ilford plates, 400 μ thick, emulsion no. Z 6278) flown in July, 1952, for 8 hr at balloon altitudes, the beta-active speck reproduced in Fig. 1 has been found.

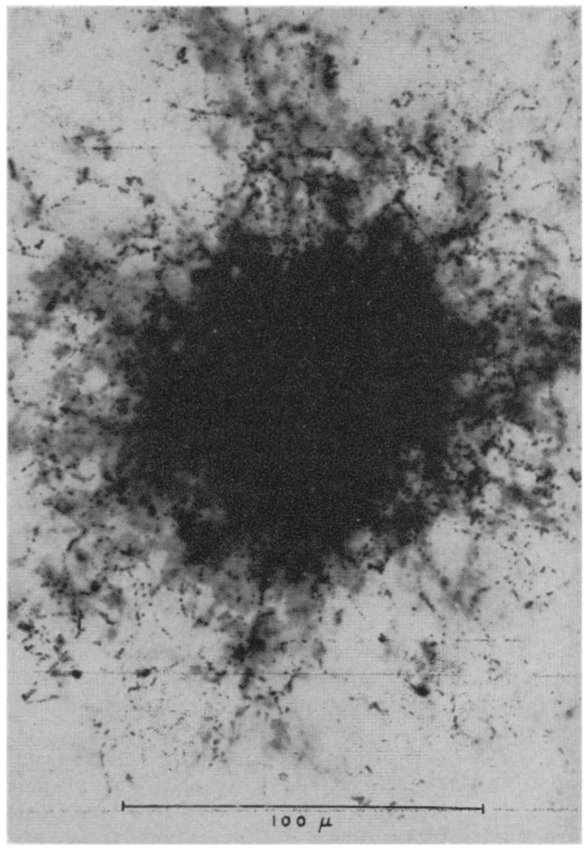

FIG. 1. Beta-active speck found in photographic emulsion.

The speck is similar to that recently described by Yagoda (*1*). The center of the speck is at 100 μ from the air surface of the developed emulsion, and at 40 μ from the glass surface. The black core has a diameter of $\sim$ 25 μ, and the total number of beta particles emerging from it has been estimated to be around

1000. The longest beta rays have a range in the emulsion of 350 μ equivalent to an energy of $\sim$ 0.4 Mev; no alpha particles were recognizable.

The time that elapsed between the pouring of the emulsion in England and the developing in Ithaca was 23 days. Since the package containing the plates was airtight, the speck was very likely present in the original emulsion.

As pointed out by Yagoda, this kind of speck is probably due to radioactive dust produced by nuclear explosions and carried far away by the winds. Undoubtedly, many more cases similar to this will be found by other researchers, because radioactive dust is already spread everywhere in the world. The frequency of these specks in all photographic materials will certainly increase in the future, unless the emulsion manufacturers take special precautions in selecting chemicals and water that are free from atmospheric dust.

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Further Light on the Roberts Thrust, North-Central Nevada

ALTHOUGH little detailed mapping has been done in eastern Nevada, reconnaissance suggests that the classic Eureka section, long ago described by Walcott and Hague, is broadly representative of the pre-Carboniferous strata of most of the eastern Great Basin. Except for the remarkably persistent and uniform Eureka quartzite of Middle Ordovician age, the strata from Middle Cambrian to Upper Devonian consist almost wholly of carbonate rocks.

At more westerly localities, a clastic facies of Lower Ordovician rocks has long been known. But the work of Merriam and Anderson (1942) was the first to disclose that the clastic facies has been thrust over the carbonate facies in the Roberts Mountains, about 20 mi northwest of Eureka. The facies distribution requires that the overriding block moved relatively eastward.

Merriam and Anderson mapped several windows in the folded thrust, in each of which the carbonate facies is well exposed beneath the overriding clastic rocks of Ordovician age. This demonstrated a width of at least 20 mi for the thrust fault—a minimum figure of displacement, because there is no convergence in facies of overriding and overridden strata.

The known breadth of the Roberts thrust was increased by another 15 mi in 1949, when the fault was recognized in the Cortez quadrangle, northwest of the Roberts Mountains, by J. C. Crowell, C. A. Nelson, and James Gilluly.

Since 1950, work of the Geological Survey in the Mount Lewis quadrangle just northwest of Cortez has disclosed three other windows through the Roberts thrust. Carbonate rocks of Cambrian, Ordovician, and Silurian ages are exposed in these windows. The clastic rocks of the overriding plate include representatives of Silurian and Middle Devonian ages as well as of Lower and Middle Ordovician. The thrust surface separating the two facies is highly folded and indeed locally overturned, so that rocks of the window rest on rocks of the overriding plate. There is, however, nowhere a doubt as to whether a particular body of rock belongs to the eastern or western facies. There is no evidence of transition between the two, except perhaps that Silurian rocks in the most westerly window show a slight increase in clastic material.

The distinction in facies between overriding and overridden plates is emphatic in both Devonian and Ordovician: there is no question that we are dealing with a major thrust. With this extension, the known width of the Roberts thrust from the eastern Roberts Mountains to the Mount Lewis quadrangle becomes at least 45 mi.

The work of Ferguson, Roberts, and Muller has demonstrated huge thrusts still further to the west. These are of at least three ages: post-Mississippian to pre-Atoka, post-Leonard to pre-Phosphoria, and post-Triassic. Although the supposed Mississippian rocks may actually be considerably older, the pre-Atoka thrusts definitely involve rocks of Ordovician age. (No Silurian or Devonian units have been recognized by these workers.) None of these thrusts expose rocks of the eastern (carbonate) facies, although they do involve clastic Ordovician rocks like those of the upper plate of the Roberts thrust. It is inferred that the root zone of the Roberts thrust lies buried beneath the alluvium of the Reese River Valley near Battle Mountain and for at least 20 mi. to the south.

Information is still inadequate to fix the age of the Roberts thrust. In the Mount Lewis quadrangle allochthonous rocks as young as Permian and perhaps as young as Triassic rest on parts of the upper plate and are, in turn, overridden by Ordovician clastics. But whether the late Paleozoic and Mesozoic rocks have participated in the entire movement of the thrust or have been later thrust out on an older fault plate is not quite certain. Further work planned for the Crescent Valley quadrangle may throw light on this problem.

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