FRAGMENTS OF ROCK FROM A PROBABLE IMPACT EJECTA DEPOSIT IN ORDOVICIAN SEDIMENTS OF NORTHERN ILLINOIS. William F. Read, Dept. of Geology, Lawrence University, Appleton, WI 54912.

A search for impact ejecta in lower Middle Ordovician marine sediments of northern Illinois led to the discovery of rock fragments containing numerous sand-size spherules. Superficially these fragments resemble pieces of cellular chert. They are fine-grained, greyish-white in color, and of chert-like hardness. Numerous rounded cavities up to 15 mm in diameter are present in most specimens.

These fragments have been found mainly as loose pieces in stream beds. Occasionally, masses of sandstone or dolomite adhere to them. Most fragments are less than 20 cm in diameter. They are bounded by two types of surfaces: irregular fracture surfaces which cut across cavities, and relatively flat surfaces which do not cut across cavities. The flat surfaces are much less common. They suggest that the fragments came from some sort of layer-like deposit. None of these surfaces show any obvious sign of wear. It is evident that the fragments were deposited by some means other than those normally involved in sedimentation and that, having recently been set free by disintegration of the enclosing rock, they have travelled only a short distance down the stream bottoms. Though they have not yet been found in place, it is clear that their source is near the contact between Middle Ordovician St. Peter sandstone and Lower Ordovician Prairie du Chien dolomite.

The outcrop of this contact is confined, in northern Illinois, to the southwest flank of a regional uplift known as the Alston Arch. Actual exposures are seen almost exclusively in areas close to trunk streams which have excavated deep valleys through the glacial drift which normally conceals bedrock. The rock fragments here described were all found in one of two places; close to the Rock River south of the town of Oregon, or near the Illinois River north and northeast of La Salle (Fig. 1). These towns are about 80 km apart.

Thin sections show that the spherules are superficially similar to ooids. A hasty examination might well lead to the conclusion that the rock is silicified oolite. Some spherules are structurally almost identical with ooids: translucent and opaque materials are arranged in concentric layers; pseudomorphs--now microcrystalline quartz--of needle-like crystals appear to radiate outward from the center. However, as compared with most ooids, the spherules only rarely contain visible nuclei--a large, monocrystalline quartz grain in the one case noted. In addition, there are many spherules in which the translucent needles are randomly arranged, and some in which these needles clearly grew inward from the surface. A few spherules have been seen in which a relatively hard external shell has broken open, allowing the soft contents to spill out. This can occur in ooids built around a soft nucleus (1), but it is rare. By far the most abundant ingredient of the spherules is microcrystalline quartz. The composition of the (white) opaque material has yet to be determined.

The spherules are associated with somewhat larger bodies (up to the size of peas) which normally contain less opaque material. These bodies were apparently plastic when accumulation was in progress. Where in contact with spherules, their surfaces are indented. Occasionally thin sections and rock slices reveal the presence, also, of objects up to at least

5 cm. in diameter which apear to be identical with chert-like nodules of the same age which I have described as impact bombs (2).

In my opinion, the spherules are best explained as condensates from a cloud of vaporized rock produced by a major impact. Some of them may have solidified as fast as new material was added, producing objects structurally identical with ooids. Others may have achieved their present size as liquid droplets which solidified from the surface inward. An impact in what is now northern Illinois during Late-to-Middle Ordovician time would have excavated at least the upper part of its crater in Cambro-Ordovician sandstones and dolomites.

The cavities in the spherule-rich rock appear to be bubbles, which in some cases have been at least partly filled with subsequent mineral deposits. The (at present) most abundant mineral of these deposits is quartz. There are occasional small grains, however, of a mineral which appears to be tridymite. If the presence of tridymite can be verified, this will be strong evidence that the spherule-rich rock fragments came from a deposit which was more igneous than sedimentary in character. Like an ignimbrite, it may have been hot enough to weld itself together, and generate bubbles, after deposition. Whatever its origin, the reason for its subsequent fragmentation is as yet purely a matter of speculation.

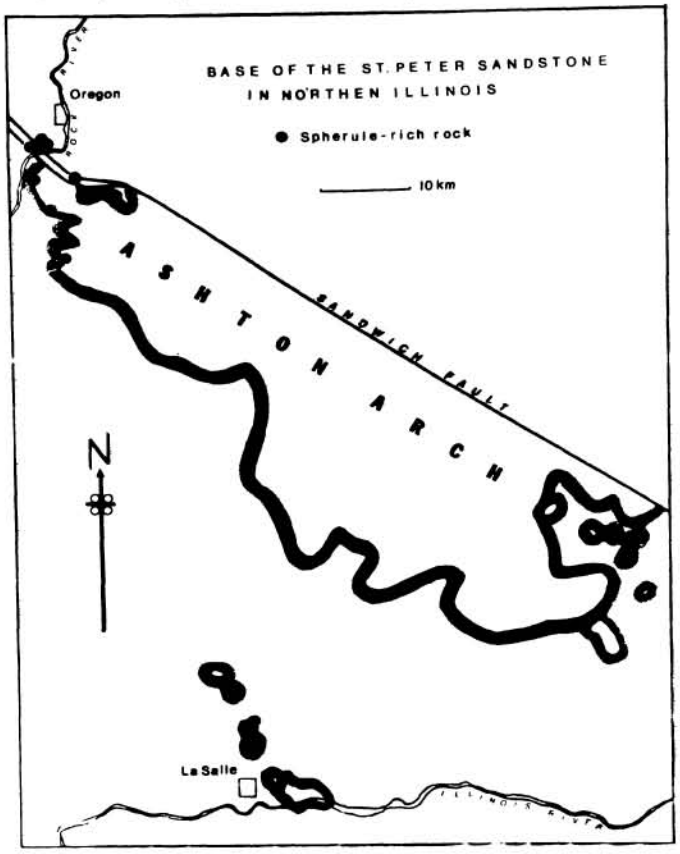

Fig. 1

REFERENCES

1. Carozzi, A.V., J. Sed. Petrol. 31, 262-274, 1961.
2. Read, W.F., Lunar and Planetary Science XVI, 687-688, 1985.