IRIDIUM DISCOVERY AT THE JEPThA KNOB CRYPTOEXPLOSION STRUCTURE,  
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Jeptha Knob is one of a class of geologic structures called  
"cryptovolcanic" by Bucher (1), which are now called "cryptoexplosion" and  
most of which are now generally accepted to represent meteorite or comet  
impacts. In addition to the reasons presented earlier (2), the recent  
finding of anomalously high iridium in breccias strongly suggests that  
Jeptha Knob is an impact structure. The Ordovician rocks of the region  
are intensively deformed under and surrounding the undeformed Silurian cap  
rock. Breccias, faults and folds are present, outward from the center,  
respectively for a total radius of about 8,000 feet (2440 m). 

Background. The first geologic report on Jeptha Knob was by Linney  
(3). Then followed Bucher's study and mapping of the feature (4).  
Cressman (5,6) mapped the feature and surrounding region. Cressman (7)  
also discussed the surface geology. 

Seeger (2) studied Jeptha Knob using geophysical methods, a magnetic  
and gravity survey, to supplement the rather meager subsurface  
information. Such methods would be very likely to reveal a buried  
structure caused by a volcanic or tectonic event. The magnetic survey  
showed that there is not likely to be a basement counterpart to the Jeptha  
Knob structure, and the gravity features observed can be totally explained  
by the densities of the near surface sedimentary rocks. Furthermore, the  
drilling information available seemed to show that the disturbance  
decreases with depth and at rather shallow depth. Seeger (2) concluded  
that the Jeptha Knob structure is the result of a violently disruptive  
process which occurred in its entirety during a very brief period of the  
early Silurian. The formation of the Jeptha Knob structure was extremely  
rapid, and all the deformation seems to have been contemporaneous. It is  
best explained as an impact structure. 

Seeger (2) modeled the original structure of Jeptha Knob using the  
known parameters of such craters (8). The model was based on the best  
known parameter presently available, the extent of the capping undisturbed  
Silurian rocks. The original crater was found to have the following  
probable minimum dimensions: Apparent diameter 6600 ft. (2010 m);  
Apparent depth 920 ft. (280 m); Rim height 290 ft. (88 m); Depth to the  
limit of major brecciation 1600 ft. (490 m).  

The model dimensions above assume a simple, cup-shaped crater was  
formed. It is possible, though, that the structure discussed above is the  
central peak area of a much larger, complex crater. This could be  
supported by the finding of breccias in the lower Brassfield formation 20  
miles (32km) away (7) or farther (9). If it was a central peak crater we  
could expect the uplifted rocks to represent about 10 percent of the  
original diameter (10) or a minimum original crater of about 15 miles  
(24km). This suggests that the above mentioned breccias are at about the  
limit of the probable dimensions or about 15 percent (10).  

Discussion. The above findings, along with complete absence of any  
other indication of endogenetic activity, volcanism, or tectonism of any  
type, forced Seeger (2) to conclude that the Jeptha Knob structure is  
indeed the result of hypervelocity impact of a meteorite or comet. This  
conclusion seems to be confirmed by the finding of anomalously high
iridium \((0.108 \pm 0.014 \text{ ppb})\), in the highest breccias found by Seeger, compared to much lower concentration in other breccias from Jeptha Knob and the Versailles structure, and other rocks.

These breccias occur in the upper parts of Jeptha Knob at elevations of \(1050-1100\) feet \((320-335 \text{ m})\). They contain clasts of various Ordovician lithologies (limestones, shales, calcite crystals) in buff to brown matrix of dolomitized and limonitized limestones assigned to the Brassfield formation (Lowermost Silurian).

For reasons stated elsewhere (11, 12, 13), we accept that the iridium is of extraterrestrial origin. Then, there would seem to be several hypotheses which could explain its occurrence at Jeptha Knob:

A. It was deposited as the result of a world-wide event at the close of Ordovician times. This is an appealing idea (11, 12), but the evidence of other occurrences is, for the present, not available.

B. It was deposited as a result of a much larger regional event. This hypothesis lacks support, also, at the present time.

C. The iridium is associated only with the Jeptha Knob structure itself, as discussed above, with the simple crater model to be preferred. Ockham's razor would seem to require that this hypothesis be favored at the present time.

References: