

Geochronological Constraints on the Timing of Proposed Ordovician Meteorite Event Impact Structures in North America

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This thesis presents an attempt to determine the formation age of two medium sized impact structures in North America. The Ames Astrobleme is a complex, oil producing structure buried ~10 km deep near the town of Ames, Oklahoma. The Slate Islands are an archipelago of 17 islands SW of Terrace Bay Ontario which represent the eroded remnant of the central uplift peak of an ancient impact structure. Both structures have been put forward as candidates for formation during the Ordovician Meteorite Event (OME). Evidence from Sweden, Russia and China indicate the OME was a drastic increase in the number of meteorite impacts following the breakup of the L-Chondrite Parent Body ~480 Ma. Yet despite the long lasting and global nature of this event, no OME material has been conclusively found in North America.

Previous attempts have been made to determine the formation ages of the Ames Astrobleme and the Slate Islands archipelago based on biostratigraphic and stratigraphic information. This thesis presents new information which will enable us to better constrain the geologic history of the structures. Whereas previous work attempted to determine the age of the structures using material produced during the impact, this project analyzes material in the basement bedrock involved in the crater formation. Samples of impact melt breccias and shocked target rock were collected from each of the impact structures. Zircons and feldspars were extracted and dated. The zircons were dated via U-Pb analysis using both LA-ICP-MS at the University of Texas at Austin and SIMS at the University of Heidelberg. Feldspars were dated via $^{40}\text{Ar}/^{39}\text{Ar}$ analysis at Oregon State University. The returned data allows us to better constrain the initial formation ages of the lithologic units present in both structures and also suggests at the Phanerozoic thermal histories of the areas around each structure. The data does not conclusively prove an OME origin for the structures, but also does not rule out such a genesis. Further work will determine the cause of such discrepancies between the differing lines of evidence.

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