AN EARLY/MIDDLE DEVONIAN $^{40}AR/^{39}AR$ AGE FOR THE CHARLEVOIX IMPACT STRUCTURE (QUEBEC, CANADA) – AN APPROACH CLOSER TO REALITY

E. Buchner[1], M. Schmieder[2], W. H. Schwarz[3], M. Trieloff[3], J. Hopp[3]. [1]Universität Stuttgart, Germany, elmar.buchner@geologie.uni-stuttgart.de, [2]University of Western Australia, Crawley, Australia, [3]Universität Heidelberg, Germany.

Introduction: The ~54 km Charlevoix impact structure is hosted in ~0.9 Ga crystalline rocks of the Grenville Province of the Canadian Shield that are overlain by Middle Ordovician sedimentary rocks. Impactites mainly comprise impact melt rocks of variable appearance and textures, as well as pseudotachylitic breccia dikes in the shocked crater basement. Although the Charlevoix impact structure has been studied for a long time, no precise data for the age of the impact event exist. The maximum impact age is defined by the occurrence of shatter-coned Middle Ordovician limestones (~460-450 Ma) in downfaulted parts of the impact structure [1]. The southeastern part of the impact structure is overthrusted by the northern Appalachian front along the Logan's Line. The Late Devonian terminal Acadian orogeny (~377 Ma [2]), thus, marks the minimum impact age [1].

Existing Age Constraints: The first K-Ar ages for impact melt rocks obtained by [3] yielded (recalculated) Carboniferous ages between 321 and 356 Ma for the Charlevoix impact structure. $^{40}Ar/^{39}Ar$ laser spot total fusion analyses of impact melt rocks and pseudotachylite by [4] suggested an Early Ordovician impact age around ~470-460 Ma. Taking the field geological constraints into account, both an early Ordovician and a Carboniferous impact age seem unrealistic. Previous $^{40}Ar/^{39}Ar$ step-heating analysis by [1] yielded a pseudo-plateau age of ~362 Ma and an older 414 ± 12 Ma (2σ) isochron age. [1] concluded that the ~362 Ma age might reflect late Acadian tectonism whereas the older isochron might offer an Early Devonian impact age.

Samples and Dating: An optically fresh fluidal-vesicular impact melt rock from Sainte-Irénée (~3 km east of the central uplift summit) was chosen for $^{40}Ar/^{39}Ar$ step-heating analysis at the University of Heidelberg, using the 328.5 ± 1.1 Ma (1σ) BMus/2 standard (K decay constants after [5]; see [6] for details).

Dating Results and Interpretation: The new $^{40}Ar/^{39}Ar$ age spectrum yields younger apparent ages in the first 8 low- to medium-temperature steps (~340-380 Ma; ~55% of ^{39}Ar released), 6 intermediate steps with ages of ~400 Ma (~35% of ^{39}Ar), and older apparent ages (~420-930 Ma) in the 4 high-temperature steps (~9% of ^{39}Ar). In accord with [1], late Acadian tectonism in the Charlevoix area might be responsible for at least partial thermal resetting of the impact melt rock, showing a 350-380 Ma signal. Whereas the older apparent ages around 930 Ma clearly reflect the local Grenvillian country rock cooling ages, the pseudo-plateau age of 399 ± 6 Ma may suggest an impact age around the Early/Middle Devonian transition (397.5 ± 2.5 Ma [7]), in line with the results by [1].

References: [1] Buchner et al. 2010. Abstract #2017. 41st Lunar and Planetary Science Conference. [2] Castonguay S. et al. 2001. *Geology* 113:144-147. [3] Rondot J. 1971. *J. Geophys. Res.* 76:5414-5423. [4] Whitehead J. et al. 2003. Abstract #4084. 3rd Large Meteorite Impacts Conference. [5] Steiger R.H. and Jäger E. 1977. *Earth Planet. Sci. Lett.* 36:359-362. [6] Schwarz W. H. and Trieloff M. 2007. *Chem. Geol.* 242:218-231. [7] Ogg G. et al. 2008. *The Concise Geologic Time Scale*, Cambridge Univ. Press, UK, 184 p.