RESEARCH IN THE TERNARY SPACE – FIELD GEOLOGY – ISOTOPE DATING – IMPACT EXPERIMENTS

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Moving: Lets assume, the field of action of an impact researcher is confined by the corners "Field Geology", "Isotope Dating", and "Impact Experiments" (modified after [1]). Than start from the "Field Geology component", and move into the direction of the "Isotope Dating component", by working on the Rb-Sr dating system of lunar rocks. My research resulted in two fundamental perceptions: One can get a very precise internal isochron but interpretation remains tricky without geological context and with just vague concepts of resetting mechanisms under the extreme p-T conditions of an impact event [2].

Extending Research towards the "Impact Experiment component": In a combined effort of field studies (Haughton crater, and Archean Basement; Devon Island), shock recovery experiments, and isotope dating, we published some cornerstone results for interpretation of isotope data as "impact ages": The U-Pb system in zircon and monazite separated from highly shocked gneiss samples still gives the primary pre-shock age [3]. The same result is found for zircon, monazite, and titanite, shocked experimentally to 59 GPa [4], while the Rb-Sr system is heavily disturbed. Meanwhile, results gained by situ dating techniques, combined with geochemical and structural data for single minerals at extremely high resolution yielded a solid data base for interpretation of isotope ages in the context of impact [5].

Back and Forth: The Chicxulub impact and the K/T mass extinction [6] were topics of one of the most vigorous geoscientific disputes ever. In this context, shock-induced melting and degassing behavior of calcite and anhydrite formed a central question. Our microscopic [7], and shock experimental studies [8], and modeling [9] (*Note: One more component is added to the ternary system!*) now provide the framework to understand this problem. Moreover, field work [10] and geochemical analyses at high spatial resolution [11] helped to rectify misinterpretations of local observations.

Outlook: As documented, e.g., at the "Bridging the Gap II" workshop [12] interdisciplinary cooperation fosters progress in understanding all the complex processes summarized under the term impact. Most recently, experimental cratering at the mesoscale within the frame of the MEMIN unit furnishes geoscientific and physical data as solid input data for modeling that allow extrapolate observations at small terrestrial impact craters [13]. Viribus unitis!

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