PROVING A LARGE RECENT IMPACT CRATER IN TROPICAL HUMID CLIMATE (PANTASMA CRATER CASE): NOT AN EASY TASK WITHOUT DRILLING!

Introduction: Proving an impact crater (e.g. [1,2]) means finding robust diagnostic features for shock metamorphism (shatter cones, shocked quartz, HP phases, etc.) or extraterrestrial contamination. Such indices can be found either inside the crater cavity, or in the ejecta blanket. On a recent crater outside arid areas, there are generally no outcrops of impactites in the depression as they have been covered by post impact sediments. Outcrops occur mostly on the rims but rim target rocks usually do not record high pressures. On the other hand, finding remnant of the ejecta blanket is not granted. That’s why a number of candidate craters in tropical humid areas remain unconfirmed without drilling in the central depression to sample impactites with high-pressure record and/or extraterrestrial contamination. One can cite, for example, Colonia (Brazil [3]) and Darwin (Tasmania [4]), for which drilling has been performed, but without reaching impactites.

The Pantasma crater case: The circa 14 km diameter Pantasma circular structure in Oligocene volcanic rocks in Nicaragua has recently been reported as a new impact crater [5]. Geomorphology, field mapping, petrographic and geochemical investigations are all consistent with an impact origin for the Pantasma structure. Observations supporting an impact origin include outward-dipping volcanic flows, the presence of former melt-bearing polymict breccia, impact glass (with lechatelierite and H\(_2\)O content < 300 ppm), and also a possible ejecta layer containing Paleozoic rocks which originated from hundreds of meters below the surface. Diagnostic evidence for impact is provided by detection in impact glass of the former presence of reidite in granular zircon [6] as well as coesite, and extra-terrestrial \(^{26}\)Cr value in polymict breccia. Four \(^{40}\)Ar/\(^{39}\)Ar plateau ages with a combined weighted mean age of 809 ± 6 ka (2 \(\sigma\)) were obtained on impact glass. This age is consistent with geomorphological data and erosion modeling, which all suggest a rather young crater.

No shatter cones were observed (in line with the lack of target or impactites outcrops inside the depression) and no shocked quartz (in line with the rarity to absence of quartz in the target rocks).

We note that the diagnostic evidence for impact were derived from rare “float” samples found in river bed gravels near the crater center, as either small pebbles of impact glass, or as larger suevite-like boulders. This seems less convincing than in-situ obtained samples, but this is the norm in recent undrilled craters as erosional level inside the depression has not reached the crater floor. Finding evidence of impact is easier in older craters. Vegetation cover and surface weathering in humid climate also strongly limit the availability of samples with diagnostic impact evidence.