PETROGRAPHY OF ROCKS FROM THE IMPACT TO POST-IMPACT TRANSITION LAYER AT THE EL'GYGYTGYN IMPACT STRUCTURE IN CHUKOTKA, ARCTIC RUSSIA.

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Introduction: Located in Chukotka, in the northeast of Russia, the El’gygytgyn impact structure is a 3.6 Ma old feature that was formed mostly in acidic volcanic rocks. The 18-km- diameter circular depression is filled by Lake El’gygytgyn (with a diameter of about 12 km), which is an ideal sediment trap expected to contain paleoecological information. The International Continental Scientific Drilling Program (ICDP) coordinated and largely financed an international drilling project at El’gygytgyn in 2009. During this project, which, due to its logistical and financial challenges, took almost a decade to come to fruition, a total of 642.3 m of drill core was recovered at two sites, from four holes. The obtained material included sedimentary and impactite rocks. Impactites were recovered from 316.08 to 517.30 m depth below lake bottom (mblb) (see [1] for details). Lithostratigraphically, the drill cores comprise massive sequences of lacustrine sediments, impact breccias, and deformed target rocks. The Late Cretaceous target rocks consist of lavas, tuffs, and ignimbrites of rhyolitic, dacitic, and andesitic compositions with modest occurrences of basalt. The impactite sequence was subdivided (see [1]) into three main parts: from 316 to 390 mblb, a polymict lithic impact breccia, mostly suevite, with volcanic and impact melt clasts that locally contain shocked mineral grains, in a fine-grained clastic matrix; from 390 to 423 mblb, a brecciated sequence of volcanic rocks including both felsic and mafic (basalt) members; and from 423 to 517 mblb, a greenish rhyodacitic ignimbrite (mostly monomict breccia). The uppermost impactite (316–328 mblb) contains lacustrine sediment mixed with impact-affected components [1]. The section immediately on top of the impactite sequence was so far not investigated.

Materials: The transition zone (313.73–316.77 mblf) between the impact sequence (see [1] and references there-in) and the post-impact lacustrine sequence, which may represent the immediate post-impact fallback zone, similar to for example what has been found at the Bosumtwi impact crater [2], comprises a mixture of three meters of loose sedimentary and volcanic material hosting isolated clasts between the lowermost lacustrine lake sediments and the uppermost reworked suevite. The first macroscopic observations of this section yielded isolated clasts embedded in lacustrine sediments on top, underlain by a greywacke-like sediment with fine- to coarse-grained sand clasts (middle of the 97Q-1 core section). A thin fine-grained laminated silt to sand zone separates the greywacke-like sediment from a coarser-grained sediment hosting lithic clasts up to 1 cm in size (end of 97Q-1). Below, a large clast of possible impact breccia which is embedded in fine-grained sand layers was recovered (top of 97Q-2) [3].

Results: Clast size and abundance of clasts embedded in fine- to coarse-grained sand layers increase with increasing depth in the core. The first investigations of this transition zone were conducted using an optical microscope on 27 polished thin sections prepared from 23 different drill core samples. Under the microscope, the samples exhibit an agglomeration of non-shocked and shocked particles and can be classified as unsorted polymict impact breccias with partial intercalations of fine-grained lacustrine sediments. Planar features (PFs) and planar deformation features (PDFs) were observed in a few quartz and feldspar grains (50-100 μm in size) present as free grains in the matrix. The abundance of shocked grains and number of sets per grain seems to increase downwards (based on a qualitative estimation). The characterized kinked micas and amphibole grains, diaplectic quartz glass (with coesite), lechatelierite, numerous impact melt shards and microtektite-like spherules, are related to the impact event. Particularly interesting are various different melt fragments whose distinction from volcanic and impact origin represents a major challenge. The size and number of the melt fragments increase downwards in the core. PDFs in quartz and feldspar grains occur already in samples in close proximity to the lacustrine sediments. Microtektite-like spherules, diaplectic quartz glass, and lechatelierite, however, appear about one meter below the top of the onset of the transition zone, marking the possible beginning of the more coherent impact ejecta layer.

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