CONTINENTAL IMPACT DEBRIS IN THE ELTANIN IMPACT LAYER

K. Petreshock[1], D. Abbott[2] and C. Glatz[3]
[1] Barnard College, 3001 Broadway #4437 New York, NY 10027 kp294@barnard.edu [2]Lamont-Doherty Earth Observatory, 1000 Rt. 9W Palisades, NY 10964-1000 dallas@ldeo.columbia.edu
[3] 3703 Sandy Forks Kingswood, Tx 77339

Introduction: There are about 165 known terrestrial craters on earth, 80% of which were formed on continental crust. Because the ocean floor covers about 60% of the Earth's surface, it is expected that many deep-ocean impact craters exist [1]. The Eltanin crater, located in the Bellinghausen Sea, south of the Pacific Ocean, is a possible result of an abyssal oceanic impact event of the late Pliocene. It is centered at 53° 7'S, 90° 1'W with an estimated diameter of 132±5 km [2]. The Eltanin impact layer was first discovered as an Iridium anomaly in 1981 [3]. Meteoritic fragments of a basaltic achrondite were found in sediment cores. Ni-rich spherules, like those found in the Chixculub impact have also been found in cores [4]. Samples from the cores ELT 13-4 and ELT 13-3 are accepted to be part of this oceanic impact layer. These cores showed the original Iridium anomalies. An additional four Conrad cores (RC18-33, RC12-230, RC12-228, and RC17-211) are believed to be a part of the Eltanin layer because they have the same biostratigraphic date, are 1 to 7 meters thick, and have high magnetic susceptibility. Two of these cores have tektites within the layer of high magnetic susceptibility [2]. We report on findings suggestive of impact origin for the layer in RC18-33 and on associated continental impact debris in core ELT13-4.

Correlation of Iridium with Magnetic Susceptibility: Because the metallic portions of meteorites are very high in iridium, high magnetic susceptibility may correlate with high iridium contents. We have tested this idea by measuring the magnetic susceptibility of the layers in ELT13-3 and ELT13-4 that were previously measured for iridium content. We find that there is a lot of local variation in magnetic susceptibility but that the regions of high magnetic susceptibility are broadly correlated with the regions of high Ir content.

New Late Pliocene Impact Layers in RC18-33? : In one of these Conrad cores, RC18-33, we have found Ni rich iron with no Cr at 446-447 cm depth. At the same depth, we have found a plagioclase-pyroxene rock that resembles the plutonic portion of the oceanic crust (Figure 1a). We have also found a plagioclase feldspar grain with multiple fracture directions and with a possible local point melt. The plagioclase-pyroxene rock might represent part of the oceanic plutonic complex excavated by the impact. If so, the source crater must have had a minimum diameter of 30 to 70 km. We found these rocks and metallic fragments by doing magnetic separation of the highest susceptibility portion of core RC18-33. We plan to continue this strategy on the other 3 Conrad cores and will report on our results at the meeting.

Potassium Feldspar Spherules: The chemical composition and size of spherules in the ejecta blanket can suggest the type of impact that has occurred. Spherules are microtektites that melted in the vapor cloud of the impact and solidified in spherical form [6]. In the Eltanin impact layer in PS27081-1, the maximum spherule concentrations are found ~95 cm below the top of the impact layer [7]. The ELT13-4 core was found to contain three potassium feldspar spherules at a depth of 1300 cm. Samples from 1296 cm and 1315 cm depth also contained one K-feldspar spherule each. These spherules have a diameter ranging from 150 to170 μm (Figure 1b). SEM results show that the K-feldspar is about 53% K and 47% Na. This high content of K is indicative of an impact onto continental crust [5]. A spherule containing high levels of iron and magnesium was found in the same layer at 1296 cm depth in ELT 13-4. The high Fe, high Mg bearing impact spherule has a diameter of 154μm, similar to the K-feldspar spherules. The two types of spherules may or may not be a result of the same event. Because there are many spherules high in potassium, we hope to define an age using Ar/Ar dating. The date will show the age of a possible simultaneous continental impact or give an age for the lower contact of the Eltanin impact layer.

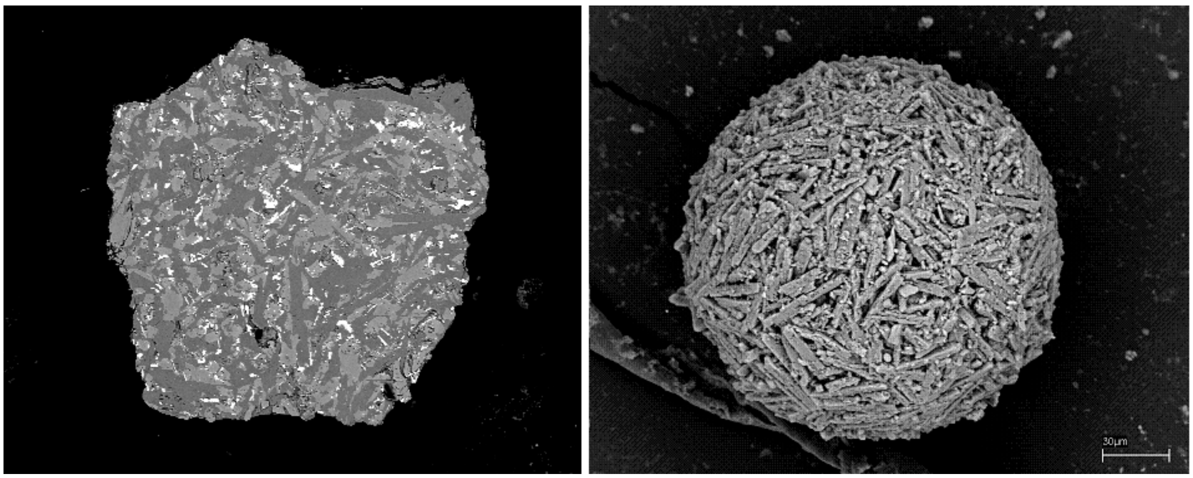

Figure 1 (a: left). SEM backscatter image of thin section of plutonic rock from RC18-33. White elongated crystals: ilmenite. Light gray groundmass: pyroxene. Dark gray elongated crystals: Plagioclase feldspar. (b: right) SEM backscatter image of microkrystite type impact spherule from ELT13-4. The crystals are Na rich K-feldspar and must have a continental provenance.

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