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The Surprise Meteorite Fall in Russia, February, 2013

Fragment of Chelyabinsk, the LL5 ordinary chondrite that fell near Chebarkul Lake, Russia. Click for enlargement.

A variety of data and preliminary analyses are available online for the February 15, 2013 meteor blast above the city of Chelyabinsk, Russia. The shock wave, resulting from the explosive deceleration and break-up of the meteoroid in our atmosphere, caused structural damage to buildings and shattered windows, injuring an estimated 1,200 people in this city of 1.1 million people. This CosmoSparks highlights online resources carrying extensive coverage of the emerging analyses of the ***meteoroid***, ***meteor***, and ***meteorites***.

The Chelyabinsk event was heard literally around the world. Infrasound stations (a network associated with the Comprehensive Test Ban Treaty Organization, CTBTO) detected the very low-frequency sound waves of the meteor blast. According to a ***CTBTO press release***, the infrasonic waves from the Chelyabinsk meteor blast were the largest ever recorded by their International Monitoring System, which included readings from stations in Hawaii (see ***@isoundhunter on Twitter***) and near the antipode in Antarctica. The infrasonic signals are used to help determine the size and velocity of the incoming meteoroid, the direction it traveled, and the energy released when it exploded over Russia. Preliminary indications reported by ***NASA Science News*** are that the meteoroid was 17-20 meters (55-65 feet) wide, weighed about 10,000 tons, traveled into the atmosphere at 18 kilometers/second (40,000 mph) on a 20^{o}, low-angle trajectory, shattered 19-24 kilometers (12-15 miles) above Earth's surface releasing energy exceeding 470 kilotons of TNT and dropping fragments in a strewn field whose extent has yet to be determined.

The shattering of the meteoroid (or bolide), the streak of the meteor (or fireball) in the morning sky, and the recovery of the meteorites are brilliantly documented by ***The Laboratory of Meteoritics*** at the ***Vernadsky Institute*** of the Russian Academy of Science. The website offers an extensive collection of photographs and eyewitness videos. The largest piece of the meteorite may have fallen about 80 kilometers (50 miles) west of Chelyabinsk in Chebarkul Lake creating a six-meter-diameter-round hole in the ice, though this has not been confirmed since divers sent into the lake, soon after the meteorite fragments fell, encountered only the silty lake bottom. If it is recovered, it would represent an outcrop-scale piece of the asteroidal parent body. The small fragments recovered from the strewn field have a preliminary classification of heavily-shocked LL5 ***ordinary chondrite***. Cyril Lorenz of the Laboratory has further determined the stones to be shock melted ***breccias***. The meteorite is officially named Chelyabinsk [***Data link*** from the Meteoritical Bulletin].

Unlike Almahata Sitta, the first observed fall of a tracked asteroid (see **PSRD** article: ***Asteroid, Meteor, Meteorite***), the observed fall over Chelyabinsk came without warning because the meteoroid was too small to detect ahead of time. Bill Cooke, of NASA's Meteoroid Environment Office, has posted an answer to: ***Why wasn't the Russian meteor detected before it entered the atmosphere?***

(pdf version)

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