



Certificate – The Muonionalusta iron meteorites

Our planet receives up to a thousand tons of extraterrestrial material every day. Only a minute fraction (< 1%) of this influx constitutes recoverable rock fragments, i.e., meteorites. The most populous of the meteorite classes are the silicate-dominated chondrites (ca 85%), which represent the oldest and most primitive (undifferentiated) rocks of the solar system. Among the non-chondritic meteorites, the irons stand out as an important class, accounting for ca 5% of all observed falls. An iron meteorite, consisting of Fe-Ni alloys and lesser amounts of sulphides (primarily troilite, FeS) and oxides, represents a piece of the core of a disrupted, differentiated planetary body (an asteroid).

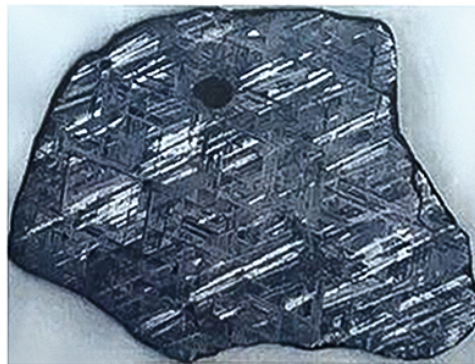
The Muonionalusta iron meteorites are found in a 25 × 15 km area in the northern part of the Pajala District, Norrbotten County, Sweden, centered at 67° 49' N, 23° 9' O. The first find was made in 1906 and the total number of meteorites found until today (2014) amounts to several hundred, with masses ranging from <1 kg to more than 1 metric ton (the largest reported specimen weighing 1185 kg). The fall of the Muonionalusta meteorites is dated to between 120,000 and 800,000 years ago and they have survived repeated glaciation by ice sheets in northern Scandinavia since their fall. Hence, the Muonionalusta strewn field represents one of the largest and oldest meteorite strewn fields on Earth.

With respect to composition and structure, the Muonionalusta meteorites are fine octahedrites and belong to the chemical-genetical group IVA, which accounts for 8.3% of all iron meteorites known. On average, the Muonionalusta meteorites consists of ~90% Fe, 8.8% Ni, and 0.4% Co. Cut and etched sections show an exquisite Widmanstätten pattern with long kamacite (α -Fe,Ni) lamellae. Like many other iron meteorites, Muonionalusta has experienced severe pre-terrestrial shock deformation, manifested in the presence of e.g. Neumann bands, shock-melted troilite, and the rare mineral stishovite, whose first occurrence in an iron meteorite was identified in a Muonionalusta specimen.

/Clas Hättestrand



*A Muonionalusta meteorite
with a weight of 105 kg,
recovered from 2.3 m soil depth*



*Sliced and etched surface of a
Muonionalusta meteorite, showing a
well-developed Widmanstätten pattern*

Department of Physical Geography and Quaternary Geology