METEORITES AND TEKTITES

(as demonstrated at Ipswich Museum 10 March 2012 for Science Week)

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plus

THE ASHDON METEORITE

METEORITES – rocky or metallic pieces of asteroids or planets that have been knocked off their parent body and have ended up on Earth. Some may have never formed large bodies.

'IAB' METEORITE – an iron-rich meteorite ('Canyon Diablo iron') found near Barringe impact crater ('Meteor Crater') in Arizona, USA. It shows regmaglypts ('thumb-prints'), ablation features produced by melting and loss of material during its fiery descent through Earth's atmosphere some 30,000 or more years ago.

'IIICD' METEORITE – found at Liku and Yaozi Town, Nanton County, Guangxi, China. It contains 92.3% iron and 6.96% nickel, and fell to Earth in 1516 A.D..

'IVA' METEORITE – a piece of nickel-iron Gibeon meteorite found in Great Namaland, Namibia. The Gibeon strewn field covers an area 70 × 230 miles. The specimen has been cut, polished and etched with acid which preferentially dissolves areas of different nickel content. The resultant surface reveals Widmanstätten patterns (named after Count Aloïs von Widmanstätten) of different crystal faces when light shines from different directions. The high iron content of such meteorites shows that molten asteroidal cores (later shattered by impacts) had differentiated in early Solar System times.

METEORITE – from the large 'strewnfields' in the north-western Sahara.

'L3.5' METEORITE – found in north west Africa. A 'stony' chondrite meteorite with a fine-grained matrix, well defined chondrules (small roughly spherical masses) and low iron (1–10% by weight) content. It is an accreted piece of the gas and dust cloud (solar nebula) that formed our Solar System, and which material contained minute remains of stars that were even older than our Sun and planets. This rock has been very little affected by heat and pressure since it formed some 4,560 million or more years ago, and has a composition similar to that of the Sun without hydrogen and helium. It is such material that by collisions fused to form the planets with outer rocky layers (iron and heavy elements migrated inwards to form a core), and that our Earth and ourselves were created from.

'H5' METEORITE – a chondrite found at Tindouf, Algeria. It contains 15–19% iron by weight, chondrules are few and indistinct (heating, possibly by radioactive aluminium-26, to about 750°C caused recrystallisation) and sodium-calcium aluminium silicate (a

feldspar rock-forming mineral) is beginning to crystallise out. Such fractional crystallisation changes the composition of molten magma.

'K/T' Clay – from between Maastrichtian Chalk and Danian Limestone at Stevens Klint, Denmark. It contains an anomalous amount of iridium as against normal background iridium. This is used to detect meteoric rather than terrestrial sourced material.

Impactites – are shock-produced target rocks at an impact site. They include breccia and/or melt rocks, now glass, ejecta. TEKTITES are mainly glassy objects formed from melted (and rapidly cooled) terrestrial rocks at the site of high speed (and high energy) meteor impact. They are projected at high speed to form Strewn Fields – geographical areas occupied by tektites dispersed by a single impact event. Radiometric age dating (in years) is calculated from the determination of radioactive elements and their decay products.

SUEVITE. From the Ries crater structure, Nordlingen area, South Germany. Suevite is an impact breccia (a rock containing angular fragments of previously existing rocks) with natural glass and clay, formed as deep-seated ejected material when a meteor from space impacted on the Earth. The fragments in the breccia include pieces of older crystalline rocks derived from a depth of about 1.4 kilometres; included quartz shows shock effects produced by the impact. The target area of the meteor was transformed by the impact explosion into the Ries crater structure (about 24 kilometres diameter) about 15 million years ago (potassium-argon radiogenic dating of the glass material). St George Church, Nordlingen, sits in the Ries crater structure, and is made almost entirely from suevite.

'MOLDAVITE' – a tektite from 'Czechoslovakia'. These form part of the Central European Strewn Field, and are about 15 million years old, suggesting that their source could be the Nordlingen Ries Structure in South Germany. Moldavites were the earliest ejecta to be formed, from rocks near to the meteor-target interface (Suevite formed from deeper-seated rocks). The first scientific description of tektites was of Czech specimens in 1788.

'AUSTRALITE' – a tektite from Charlotte Water, Central Australia. It is composed of black glass, with c. 73% SiO_2 and c. 12% Al_2O. One was described by Charles Darwin in 1844 in his 'Geological Observations on Volcanic Islands Visited during the voyage of H.M.S. Beagle.'

'THAILANDITE' – a tektite from Thailand. Formed about 775,000 years ago, it is the same age as the Australite. The Australasian Strewn Field covers about one-tenth of the Earth's surface.

THE ASHDON METEORITE

Just before 1 p.m. on the 9th March 1923 a rock from inter-planetary space entered the Earth's atmosphere. In only a few seconds of flight, as it passed over Saffron Walden, Essex, in a north-easterly direction, its high speed was slowed down by the air, its kinetic energy being transferred into heat and ablation (superficial melting of its surface, its interior still being at the temperature of space). At the end of its flight-path it impacted the ground about one-third of a mile south of All Saints Church, Ashdon, near Saffron Walden. Frederick Pratt, a thatcher, was about ten to fifteen yards away and heard a loud 'sissing' noise as it fell. Three days later, finding a small hole where it had come down, he found the meteorite at a depth of about two feet. It measured about 5 x 4 x 3 inches, weighed about 2 3/4 lb, and its surface was lined with fused material (where melting had cooled to form a 'crust'). The meteorite was passed to Rev. Francis Berry of Wendens Ambo and then presented to the British Museum, Natural History, at South Kensington, London. The Ashdon meteorite belongs to the 'stony' type of meteorites. It has a whitish-grey interior and is composed of silicate minerals belonging to the olivine and pyroxene groups, with shining particles of nickeliferous iron distributed throughout. Structurally it shows small spherical features called chondrules and the meteorite may thus be classified as a chondrite (a stony meteorite with chondrules).