IDAR OBERSTEIN

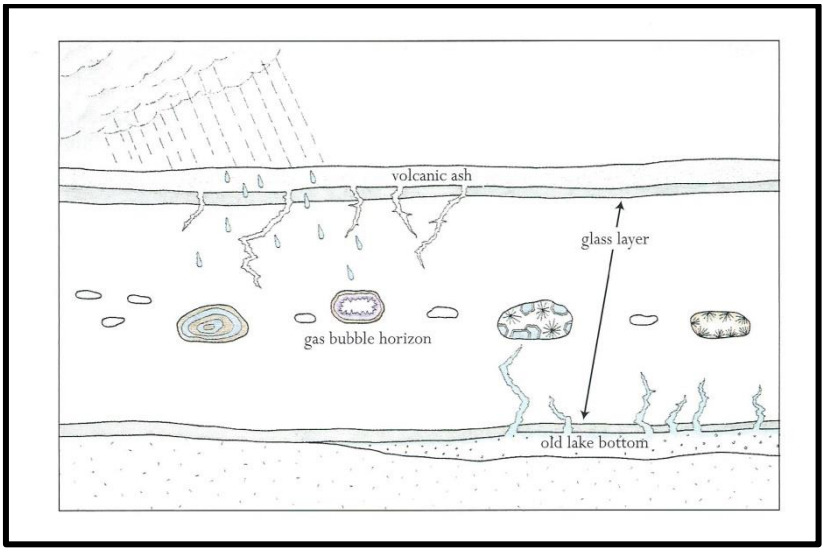
By Dr Sue Hay

Dr Sue Hay gave a most interesting talk on Idar-Oberstein in the Hunsrück area of western Rhineland where several hundred years' history of mining and gem-cutting have created one of the world's leading cut-gem trading centres. The industry was originally based on the mining and processing of amethyst, agate and jasper in geodes found locally.

The geodes were developed within a series of amygdaloidal basalts of Variscan age which outcrop and form prominent topographical features locally (e.g. the Oberstein).

Basalt lavas erupt at high temperatures (around 1,000^{0}C) and flow rapidly from their source, often swamping the surrounding countryside. If the upper and lower margins of the flows cool quickly the lava forms a glassy rock which fractures and breaks up as the flow continues. Continuing eruption can often deposit layers of volcanic ash between individual flows. If a lava flow travels across marshy or saturated ground heat from the flow can cause water trapped in the sediments below to evaporate and penetrate the overlying flow as steam. This creates irregular cavities (amygdales) within the still-molten rock above – see photo below.

Over time, rainwater (meteoric water) percolating through the flows reacts preferentially with the volcanic glass and volcanic ash leaching out silica and other minerals.



If levels of dissolved silica in this water become sufficiently high, a number of silica minerals may precipitate in the cavities/amygdales filling any openings and forming geodes. At Idar-Oberstein the geodes are predominantly infilled with agate, jasper & amethyst - the raw materials for the local gemstone industry.

During the 18th century, gemstone finds in the Hunsrück region started to diminish and people emigrated left to find work abroad, some going as far as Brazil where they played a prominent part in the Brazilian polished stone industry. Agate nodules shipped back as ballast on empty German vessels that had offloaded cargo in Brazil were then transported back to Idar-Oberstein and helped maintain the local industry to the pre-eminent position it has achieved today.

Dr Hay also spoke on the differences between minerals and gemstones.

All gemstones are minerals but there are significant differences between the two groups as shown in the table below.

<table>
<tr><th colspan="2">Minerals & Gemstones</th></tr>
<tr><th>Minerals</th><th>Gemstones</th></tr>
<tr><td>Minerals are naturally occurring inorganic solids which have defined chemical compositions and crystal structures.</td><td>A gemstone is a naturally occurring mineral that has been artificially shaped &/or faceted and polished, for decorative purposes.</td></tr>
<tr><td>A few minerals exist as native elements e.g. gold, sulphur & diamonds.</td><td>Gemstones are classified as precious (e.g. diamond, emerald & sapphire) and semi-precious (e.g. garnet, turquoise, and amethyst etc.).</td></tr>
<tr><td rowspan="2">Most minerals are composed of two or more elements. Where different minerals have the same chemical composition (e.g. Al_2SiO_5.) this often reflects the mineral's formation under different conditions of pressure and temperature.</td><td>Gemstones can be inorganic (e.g. ruby) or organic (e.g. coral & amber).</td></tr>
<tr><td>Gemstones are usually particularly pure.</td></tr>
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There are four main geological processes for forming gemstones although some gemstones may form in more than one way:

- Crystallisation from a magma - e.g. Diamonds & Sapphires
- Precipitation from an aqueous solution - e.g. Amethyst
- Chemical alteration - e.g. Native Silver & Turquoise
- Recrystallisation - e.g. Garnet

The value of a gemstone is related to the "four Cs":

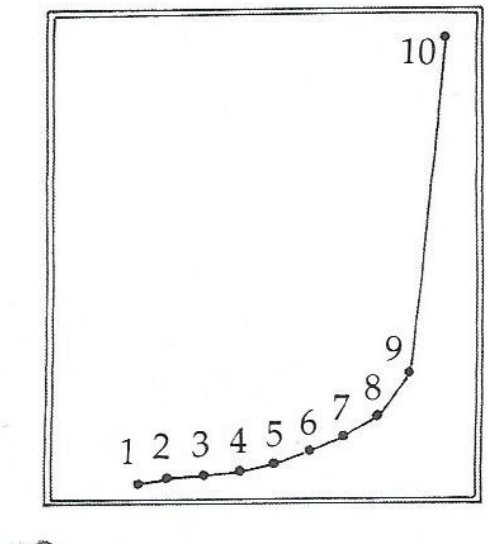
- **Colour** :- The best gems are chemically pure.
- **Clarity** : A sliding scale where the best are "flawless" (i.e. no "inclusions") to those with visible inclusions. "Inclusions" vary from flaws in the crystal structure to minute, discrete, foreign minerals "included" in the crystal lattice.
- **Cut** : This also includes Brilliance, Fire & Scintillation – a range from excellent to poor.
- **Carat** : The weight of the gem – measured in carats (1 carat = mass of 0.2gm).

Dr Hay also introduced an important distinction between those gemstones which could be faceted, and thus present enhanced "4C" characteristics, and those that could not. This is based on the hardness as measured by Mohs' Scale of Hardness.

Minerals or gemstones with hardness greater than 7 can be faceted; those with hardness less than 7 cannot.

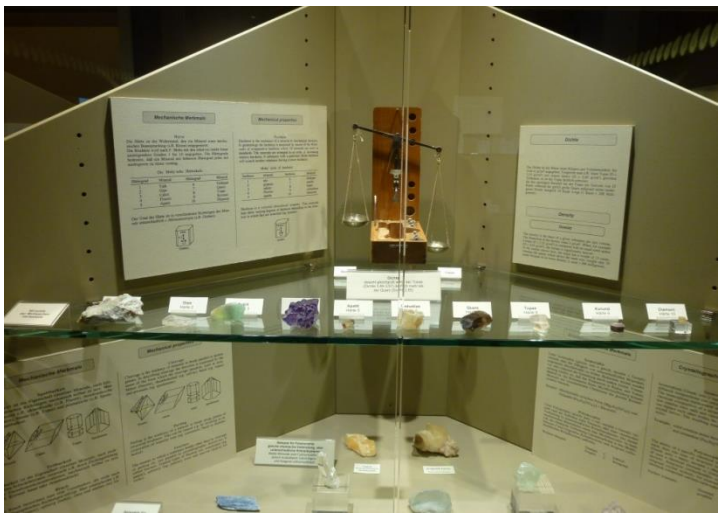
Mohs Scale of Mineral Hardness was invented by Frederick Mohs in 1812 and is based on the ability of one mineral to scratch another.

It is not a linear or logarithmic scale but a reflection of the fact that the hardness of a mineral is related to the strength of the chemical bonds in its atomic structure. There are ten minerals in Mohs scale: talc at 1, gypsum, calcite, fluorite, apatite, orthoclase, quartz, topaz, corundum, and the last and hardest, diamond at 10.



Mohs' Scale of Hardness

A display in the Geological Museum in Idar-Oberstein reflects the Mohs scale with talc on the left and diamond on the right



The Idar-Oberstein minerals all have hardness below seven and are therefore not cut or faceted but are polished or carved into a variety of shapes and objects; the most common form for jewellery produced in Idar-Oberstein being the cabochon.

The talk concluded with a series of photographs of various minerals, gemstones and artefacts on display in the local museums, some of which showed extremely high levels of professionalism and skill.