



Tanzanite

For a mineralogist, zoisite is a most unlikely candidate as a precious stone. It has been known for nearly two centuries and occasionally used as an ornamental stone of limited distribution. Zoisite, like all epidote minerals, is a structurally complex mineral and can be described as a hydrous calcium aluminium silicate. It can occur as striated crystals or amorphous lumps that are pink, pale green, blue, or white in colour.

However, in 1967, another far more attractive variety of the mineral was found near Mount Kilimanjaro in Tanzania. This stone is uniquely trichroic and in its rough form it radiates different colours from each of its three individual crystallographic axes – blue, violet and burgundy. Once cut and polished, the colour ranges from electric violets and pale blues to deep royals and rich indigos. This variety is now known as tanzanite.

From Tanzania to Tiffany's

Using a location to name a mineral is not unusual in the geological world. Usually after a period of time other examples are found elsewhere, but not in the case of tanzanite. Its relatively recent discovery, by Masaai pastoralists, and its past mining by artisanal methods has led to a somewhat turbulent history in terms of development.

This is not to say that the jewellery market has not appreciated the stone's unique appearance. Back in the 1960s, Tiffany and Company of New York, USA, introduced tanzanite to the discerning customer. But uncontrolled mining (some 30,000 artisanals were working the tanzanite mining area in 1989), meagre recoveries, theft and a poor distribution system resulted in a volatile market – with over-supply by 1997, followed by an extreme shortage in 1998 due to severe flooding that claimed

the lives of over 100 miners. The resultant roller-coaster price swings did little to endear tanzanite to investors and, although prices have remained relatively high since that period, the market still requires organisation. The cutting industry needs to better educate and, most importantly, marketing of the stone must be integrated with the retail jewellery trade worldwide.

Making a market

Ian Harebottle, President and Chief Executive Officer of TanzaniteOne Ltd, Tanzania, is working towards this goal. TanzaniteOne was formed when the company acquired the tanzanite assets of African Gem Resources Ltd (Afgem). These deposits, including Block C which extends over 8km², some 70km southeast of Arusha, were acquired by TanzaniteOne in 2004, just before the company was listed on the AIM market in London. Afgem had completed a feasibility study for mining the ore and had begun mine development in 2001.

According to Harebottle, 'the main objective is to develop a regulated market

where supply matches and grows with demand. The past erratic production resulted in relatively low rough prices and did little to help those miners upon whom the industry rested. With little money reinvested into the industry, it was going nowhere.'

Harebottle and his co-directors realised that to position tanzanite as a gemstone that would be accepted along with diamonds, sapphires and rubies similar marketing methods would be required.

First and foremost, the method used to trade the stones needed revision. Fragmented selling by miners to local Arusha-based dealers and the on-selling to intermediary beneficiaries whose core businesses were not centred on developing the tanzanite market did not reflect or support the best possible prices that could be obtained on the international market. Harebottle reviewed the precious stone market, particularly that of diamonds, where jewellers are invited to 'sightings' and packets of stones are offered. These events are invitation only so that the sellers and purchasers can regulate the market and ensure fair trade. This technique of



Cobbing – the initial trimming of the tanzanite

comes of age

Tanzanite is growing in popularity as a precious stone. Michael Forrest talks to Ian Harebottle, CEO of TanzaniteOne Ltd, about the gem's success.

marketing requires a number of 'sight' dealers and to this end TanzaniteOne has appointed six international precious stone dealers to participate in 'sightings'.

The packets given to jewellers are parcels of rough tanzanite prepared by the company, with a mix of qualities based on colour, clarity, shape and weight to best reflect the individual's requirements and business models. Grading is conducted using an in-house system.

TanzaniteOne also purchases rough tanzanite from small-scale miners and dealers, and it is intended that circa 15% of the company's revenue will come from this source.

Indian polish

The worldwide market for rough tanzanite is estimated to be worth around US\$100 million per annum. The majority of TanzaniteOne's customers are based in India and most have wholesale outlets in the USA. It is estimated that 80% of all rough tanzanite is cut and polished in India, for onward selling to the USA, Europe and, to a lesser extent, the Far East. The tanzanite cutting and polishing industry in India is very well developed and established through a long association with gemstones. Approximately 10% of the hundred or so established cutting and polishing companies account for around 50% of the overall tanzanite market.

The worldwide market for polished tanzanite at wholesale is estimated to be worth between US\$150 million and US\$200 million per annum, with margins between rough and polished typically around 30%. Such margins can be increased through branding and

promotion. TanzaniteOne has two cutting and polishing facilities in Tanzania, one in Arusha and the other on site at the mine.

Building a foundation

The company provided the seed funding for, and continues to support, the Tanzanite Foundation, which is a non-profit industry organisation and endorsement brand. The Tanzanite Foundation performs several functions that include –

- Acting as the primary vehicle for the promotion of the stone.
- Providing a ubiquitous grading system for polished tanzanite.
- Providing education and promotional services to jewellery retailers.
- Disseminating tanzanite information to consumers and industry.
- Acting as a conduit for TanzaniteOne's social investment and community projects within the tanzanite producing area in northern Tanzania.

The Foundation is in the process of licensing reputable, international, gemmological laboratories to apply the grading system and issue certificates for tanzanite and tanzanite jewellery. This will ensure that the stone is authentic and has been accurately graded according to an internationally accepted standard. In addition, a major milestone has been passed with the addition of tanzanite to the American Gem Trade Association as a December birthstone, adding to a list previously unchanged since 1912. In 2002 and 2003, tanzanite was rated the fourth most popular coloured gemstone in the USA.

Finite resource

The Merelani Tanzanite Mining area, beneath Mount Kilimanjaro, is the only known source of tanzanite in the world. This makes the stone considerably rarer than diamonds, and one with a finite resource. The host rocks are late Proterozoic metasediments that were originally a series of sands and clays rich in organic matter with elevated levels of uranium, vanadium and aluminium-rich minerals. These sediments were highly weathered and deposited in a lake. During and after the Pan-African tectono-thermal (mountain building) metamorphism, a



Drilling the ore



'The Mawenzi'

Last year, the world's largest single piece of tanzanite to have ever been mined was recovered from TanzaniteOne's Bravo shaft at a depth of 270m (see image left). Weighing in at 16,839 carats (well over three kilograms) and measuring 220mm x 80mm x 70mm, the rough tanzanite piece is impressive. It has been named 'The Mawenzi', after Kilimanjaro's second highest peak. Ian Harebottle, TanzaniteOne's President and Chief Executive Officer, commented, 'We were reluctant to name it Uhuru, after Kilimanjaro's highest peak, on the off chance that a larger piece is ever found.'

release and migration of hydrothermal fluids took place. The result was the deposition from these fluids of calcium, magnesium, vanadium, uranium, strontium and zinc, as well as heavy rare earth elements, CO₂ and SO₃, along the structurally controlled Letatema fault zone into 'chocolate-tablet' shaped boudin structures.

TanzaniteOne is developing an underground mine in its licence area. Five productive shafts (Bravo, CT, Main, Askari and Delta), two exploration shafts (No2 Shaft and TC) and some 800,000m of

underground drives have been completed. Exploration drilling has shown indications that ore bodies continue below the previously defined 300m vertical depth and consequently work is well underway to upgrade the Main, CT and Askari shafts for mining activities below 800m on true dip.

The dense media separation (DMS) and crushing plant is fully operational and has a capacity of 10,000t per month. The ore grading around 50 carats per tonne (cpt) is initially processed via the DMS unit, followed by processing in a fully automated

optical identification, separation and primary sorting unit. This technology, HOSGARS (Hands Off Sorting, Grading and Recovery System), is expected to significantly improve security while simultaneously enhancing the final grade of rough tanzanite recovered.

A new best friend?

Harebottle and his team believe that the time for tanzanite has come, and that by employing modern methods of mining and, most importantly, marketing, the stone can become as distinct and desirable as diamonds, rubies and sapphires. Certainly Henry Platt, ex-President & Chairman of Tiffany and Company, thought so when he said, 'Tanzanite is the most important gemstone discovery in over 2,000 years.'

Further information

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Material of the Month

Gold

What is it? A heavy metal, gold is the most noble of all metals. In its native form it is yellow, but in the form of colloidal gold (gold nanoparticles), the material can appear red or purple. Gold's chemical symbol, Au, is short for the Latin word for gold, 'aurum', which means 'glowing dawn'.

Location, location – Gold is found in its native condition as nuggets or grains in alluvial sand, or it occurs in ores found in a wide range of geological environments. The main sources are in South Africa, which was the world's largest producing nation in 2005, followed by Australia and the USA. Nearly half of all gold mined has come from the Witwatersrand Basin in South Africa.

In deep? Seawater also contains concentrations of gold, with higher concentrations on the ocean floor. There is currently no economically feasible way of extracting gold from the sea.

Why carats? Gold is measured in carats when selling it in the form of jewellery – pure gold being 24 carats. This is because, despite being the most ductile and malleable of all metals, it is too soft for ordinary use and is hardened by alloying with silver, copper and other metals. The addition of these materials to the mix

changes the colour of gold – for example, nickel, palladium, zinc and silver produces the fashionable white gold.

In a rush – The 19th century saw a number of gold rushes – for example, deposits of gold were discovered in Coloma, California, USA, in 1848. The San Francisco 49ers American football team is named after the workers that swarmed California in 1849 in search of their pot of gold, the '49ers'.

Keeping its sparkle – Pure gold is resistant to tarnish and corrosion, and does not oxidise when heated in air. The metal also resists attack from water and most acids, but it dissolves in aqua regia.

Life beyond jewellery? Application of this precious metal goes beyond jewellery and decorative artefacts to medicine and dentistry, due to gold's biocompatibility. Areas of development include the use of gold microchips for drug delivery into the human body, and the use of colloidal gold coated in sugars for detecting different biological toxins. The coated particles have been found to change colour according to the nature of the substance.

Good as gold? Properties such as thermal and electrical conductivity, as well as resistance to



Lunar module (Courtesy of the World Gold Council, www.gold.org)

oxidation, have meant that gold is the material of choice for electroplating conductors and constructing electronic transistors and circuits. Nanogold is an area of exciting development, particularly for use as sensors.

Sweet tooth – Edible gold flakes are used in foods such as gourmet Indian sweets.

Walking on the moon – Sheets of gold covered the lunar modules that were used during the Apollo programme that put man on the moon. The metal acted as a radiation shield that reflected heat and light, protecting the astronauts and instruments.

Golden future? Catalysts have traditionally been based on the platinum group of metals, but gold is edging in there, with potential for catalysts to operate as low as -70°C for new reactions. Potential applications include pollution control, fuel cell systems and chemical synthesis.