

Traceability of gemstones: challenges and opportunities

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The tracking and traceability of gemstones is an increasingly important issue. Consumers are ever more interested in knowing where and how the materials they consume are extracted and manufactured (Cartier, 2011; Archuleta, 2016; Nash et al., 2016). Media and NGOs are increasingly scrutinizing the gemstone industry about the origin and sustainability footprint of different gemstones (Global Witness 2015; RESP, 2016). Governments want to improve the management and revenue collected from gemstone resources and global governing bodies have highlighted issues such as smuggling and money laundering in recent years (Schroeder, 2010; UNICRI, 2013). Documenting the provenance and source of gemstones is one way of addressing these concerns; and tracking and traceability are two available mechanisms to achieve this. Although a multi-folded approach – for example a strengthening of specific ethical and sustainability standards within mining, processing and sale of gemstones worldwide - is required to address these issues, the development of techniques to track and trace gemstones is vital to the accountability and credibility of such schemes.

The recent appearance of undisclosed synthetic diamonds on the market further highlights this, how are, could and should different types of gemstones be separated on their journeys through the supply chain? Correct disclosure of sold gemstones, for example treatments in emeralds, is already required in the CIBJO Blue Books. Being able to provide information about the source of a gemstone is set to become more and more critical for jewellery houses, gemstone miners and gemstone traders, if experiences from other sectors are anything to go by. Tracking and traceability can be considered both a growing requirement for some and for others a competitive advantage. The industry today already has clear pricing gradients for natural vs. imitation (turquoise vs. imitation turquoise), natural vs. synthetic (natural spinel vs. synthetic spinel), untreated vs. treated goods (untreated ruby vs. heat treated ruby), and gemstones of different origins (Colombian emerald vs. Zambia emerald). A further level is being added by claims from mining companies, traders and jewellery houses that certain gemstones are “ethical”, “sustainable”, “fair trade”, “conflict-free” or “traceable” gemstones. In order to provide these claims with further credibility, independent verification may be required.

Gemmological science may provide assistance in such cases and this research offers an overview of possible strategies, opportunities and limitations of tracking (downstream “from mine to market”) or tracing gemstones (upstream “from market to mine”) using gemmological approaches. Advances in new technology to map unique gemstone inclusion features and characterise their chemical and spectroscopic properties can aid in these traceability measures. Advances in multi-variate statistics and whole isotope analysis at ultra-trace levels with LA-ICP-MS technology is opening up new insights in chemical fingerprinting of gemstones from different geological and geographic settings (Wang et al., 2016). At another level, the ability to combine precise multiple trace-element data points of a stone with spectroscopic measurements and machine learning technology, opens up research directions in finding unique fingerprints for unique stones. Other approaches involve physical tracing or marking a gemstone either at the mine or at a subsequent stage in the supply chain, simply involving hologramming or laser inscribing a stone or in more complex cases to use uniquely marked nanoparticles injected into fissures that will remain in an emerald even after the cutting and treatment process (Hänni & Cartier, 2013; WWD, 2017). The different marking and tracing technologies available have different approaches, there is not one unique solution for the gemstone industry.



*Figure 1. Miner with rough corundum in Zazafotsy, Madagascar. How could such material be tracked from the mine to consumer?
Photo: Laurent E. Cartier.*

However, gemmologists are well placed to assist in developing such solutions through their detailed knowledge of gemstones. Gemmological science can contribute with complimentary approaches and technology in offering additional information about a gemstone and its provenance.

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