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The Lake Harbour Marble unit (LHM) is found on the south end of Baffin Island, Nunavut, Canada. It is highly mineralized, hosting gem quality lapis lazuli, spinel, and apatite as well as phlogopite, graphite, diopside, oligoclase, quartz and hornblende. Lapis lazuli from the LHM was formed by granulite-facies regional metamorphism of a Palaeoproterozoic dolomite-evaporite sequence. The lazurite, the primary colouring mineral of lapis lazuli, is found in the traditional deep blue colour as well as paler blues and an unusual teal green. Previous research has indicated that the S-Cl ratio controls the colour of the lazurite but no comparison by chemical or spectroscopic methods of the two colours has been completed. As well, the genesis of the green lazurite has yet to be explained. Previously reported petrologic relationships have been confirmed by polarizing microscopy. Mineral chemistry (EMPA), unit cell parameters (XRD), absorption spectra (FT-IR) and the oxidation states of sulphur (XANES) have been determined for the blue and green lazurite. Variations between the two are discussed. The data from this study are compared with published values of other lapis localities such as Badakhshan, Afghanistan and Ovalle, Chile.

FM5: Gemstone Occurrences in the State of Colorado USA

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When "Minerals of Colorado" (Eckel, 1997) was published, 774 mineral species were described from Colorado, and a few new ones have been added to the list. Only a few have been used in the general jewelry trade: they are topaz, aquamarine, phenakite, diamond, turquoise, lazurite (lapis lazuli) and amazonite.

Colorado is located in the south central Rocky Mountains which is ideally suited for diverse geology. The uplifted mountains and the eroded landscapes reveal a vast assortment of rocks containing many different minerals, all reflecting the geologic environment when the rocks formed. Primary minerals are those formed in the rocks and remain essentially unaltered. Excellent examples of such deposits are Colorado's many pegmatites, where minerals found in "pockets" are the original minerals formed. Topaz from the Pikes Peak Granite and beryl variety aquamarine and goshenite occurring at 12,000 feet on Mt Antero are some. Many rich deposits are the result of oxidation, having been formed by secondary deposition when primary minerals have interacted with hydrothermal solutions or ground water. Oxidized deposits do not readily form the hard gemstones that are faceted, but do yield the important gems, especially turquoise.

The Denver Museum of Nature and Science has faceted gemstones and faceted semi-precious gemstones from Colorado in their collections. Examples are 1.2 carat phenakite, 19.95 and 13.75 carat aquamarines, 29.56 and 27.5 carat topaz, 2.75 carat diamond, 2.1 carat spessartine, .48 carat grossular, 130.6 carat quartz, 2 carat amethyst, 6.65 carat fluorite, 9.5 carat barite, 13.9 carat and 8.5 carat sphalerite, 10.1 carat apatite, 65.8 carat rhodochrosite, and also cabochons of lazurite, amazonite, and turquoise.

Pictures of these cut stones and the typical natural material they were cut from will be presented along with a map showing locations in Colorado where they occur. The geology of the deposit sites will be mentioned.

FM7: The amethyst from Alto Uruguai Mining District - Parana Basin, Brazil: mineralogical and chemical signature

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In Alto Uruguai region, north of Rio Grande do Sul State, Brazil, huge amethyst geode deposits occur in basalts of Serra Geral Formation, a late Jurassic-early Cretaceous volcanic sequence of Parana Basin. The amount and quality of gem materials has turned that region into one of the main worldwide supplier of amethyst to the international market.

Amethyst and related silica minerals were characterized by their morphology, optical properties, infrared (FTIR) and optical absorption spectroscoy, X-ray diffractometry, crystal inclusions (optical microscopy and SEM/EDS), fluid inclusions (microthermometry) and by chemical data (XRFL, ICP, INAA and EPR).

The geodes are commonly cylindrical cavities ~1 m long and usually incompletely filled with the following mineral sequence: a thin outer layer of microcrystalline quartz (fine quartz and chalcedony fibrous quartz), followed by a centimetric layer of coarse colourless to milky quartz with progressive colour zoning to euhedral amethyst. Calcite, gypsum (selenite) and barite can occur as late minerals.

Amethyst are usually single terminated centimetric crystals with transparent positive (r) and negative (z) rhombohedra, and a little developed translucent to milky hexagonal (m) prism. The colour varies from light to deep rich hues of violet (530-540 nm absorption) and is due to Fe^{4+} colour centers. Colour zoning and irregular colour distribution are common. Brazil Law twinning, known as a feature to distinguish natural from synthetic amethyst, has been observed only in some crystals. Needle-like and fibrous minute goethite crystals are common inclusions, usually developed along rhombohedral growth zones as spherulitic aggregates. Other seldom inclusions are calcite and globules of chalcedony. Fluid inclusions are of monophasic aqueous type, enclosing metastable fluids containing small amounts of Na, K, Ca, Mg and Fe.

The silica minerals have similar chemical composition with 98.06 to 100% of SiO_2, small amounts of Al and Fe (<1%), followed by K, Na, Ca, Mg, Ti and P (< 0.5%), and Ba, Zr, Y, Cu, Zn, Sr, Li, Sc and La as trace elements. X-ray reflections and cell dimensions closely resembles JCPDS standard quartz. Infrared spectra show typical absorbance of α-quartz, with aditional small peaks around 1.600 cm^{-1} due to water molecules, and broad absorbance near 3.500 cm^{-1}, due to isolated $(OH)^-$ molecules in the quartz structure.

The mineralogical and chemical results, point to characterize these geode silica minerals as essentially pure phases and indicate they have been deposited in epithermal stable conditions.

FM8: The Portuguese Crown Jewels

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With the discovery of the rich diamond fields of Brazil in the 18th century, in about 1725, the jewellery arts in Europe entered a new chapter that was dominated by the huge amount of diamonds that became available at the time, surpassing by far those from India and Borneo. In a jewel, precious metals became almost only a structure for holding the many gemstones now available, contrasting with the previous pieces dominated by those metals. Due to the fact that the Portuguese were the dominant power at that time, many jewellery masterpieces, rich in diamonds were crafted for the royalty, particularly at the end of the 18th century. Most of those still exist in their original formats in the Royal Palace of Ajuda in Lisbon, Portugal and the thousands of people that visited the fabulous diamonds exhibits in the Natural History Museum in New York and Paris and in Scuderia del Quirinale in Rome are witnesses of their glamour and wealth.

Here we present for the first time in an international meeting a collection of the most important Portuguese Crown Jewels set with fabulous diamonds, emeralds and sapphires, introducing their history, significance and gems, with a special focus on the `Jewel of The Golden Fleece'.

FM9: A path to identify archeological emeralds' origins

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