

Colombian emeralds and their "oily" heritage

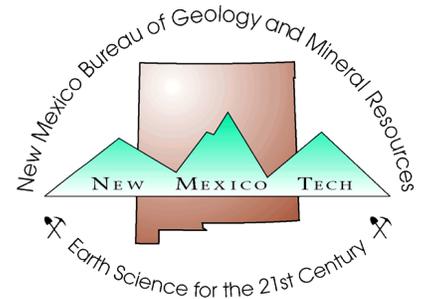
David Stoudt

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The annual [New Mexico Mineral Symposium](#) provides a forum for both professionals and amateurs interested in mineralogy. The meeting allows all to share their cumulative knowledge of mineral occurrences and provides stimulus for mineralogical studies and new mineral discoveries. In addition, the informal atmosphere encourages intimate discussions among all interested in mineralogy and associated fields.

The symposium is organized each year by the [Mineral Museum](#) at the [New Mexico Bureau of Geology & Mineral Resources](#).



Abstracts from all prior symposiums are also available: <https://geoinfo.nmt.edu/museum/minsymp/abstracts>

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Colombian Emeralds and Their “Oily” Heritage

—David Stoudt, Santa Fe, New Mexico

Colombia has a rich cultural history, ethnic diversity, biodiversity, and is rich in natural resources, including being the number one producer of fine emerald gemstones for jewelry and mineral specimen collectors in the world. The presentation will explore the Colombian emerald-countryside found in the Oriental (eastern) Cordillera Mountains and put forth a theory of emerald formation, not currently found in the voluminous, past and current literature. “Esmeraldas de Colombia (1992), Emeralds of the World (English Lapis 2009), Colombian Emeralds (Mineralogical Record 2016) and Magnificent Green (GRE Swiss Lab, 2018) are all informative, but none have made the Emerald/Oil connection. When several Bogota Colombians learned that I was making this presentation, they exclaimed, “Do not tell consumers that emeralds and oil are tied together, we may lose profits.”

The author in a 45 year career in domestic U.S. and International, oil and gas exploration/production has travelled to over 39 countries; lived and worked in several as an American expat. His focus for the past 11 years has been Colombia. This has given him significant and detailed exposure to geo-chemical oil/gas generation analyzes and analyzes of the produced oils; and that; together with numerous geo-field trips into the mountainous outcrops that host the emerald mines of Colombia and those outcrops are of interest in exploring for more of Colombia’s future oil fields. The same emerald-bearing, SURFACE geological units produce oil from the equivalent SUBSURFACE geological intervals in the oil basins to the west and east of the uplifted Cordillera holding the emerald mines. Geological coincidence, you may say?

Emeralds found around the world in 31 countries can be hosted in two types of deposits. First, the majority of emeralds are found in host rock of metamorphic/igneous origin. Second, Colombian emeralds are unique, in that, they are the only emeralds that are found in host rocks of sedimentary origin, such as marine shales and carbonates. A geological singularity, in itself.

Colombian emerald formations have three constants in their origin. First, the sedimentary host rocks are environmentally deep marine and Lower Cretaceous in age with high total organic content (TOC 3–19%). They were part of a worldwide geological event that saw biotic life eventually leading to

Colombian oil generating source rock that contained increased amounts of Beryllium (Be), Chromium (Cr), and Vanadium (V). All of those three elements play critical parts in the formation of the intense, rich green emeralds of Colombia. The produced oils from the Middle Magdalena Basin (west of the Muzo emerald mines) and the produced oils from the Llanos Basin (east of the Chivor emerald mines) have abnormal amounts of Beryllium, Chromium, and Vanadium in their analyses. Coincidence?

The second constant and critical to the formation of emeralds is the underlying Evaporite (halite) beds that gave forth saline solutions which mobilized the critical elements for emerald formation. The evaporites are confined to the bottom of the Cretaceous age basin and form piercement salt domes found today on the surface, to the northeast of Bogota. Following the days of the Spanish conquest, salt mining found emeralds in the hardened sediment surrounding the salt domes.

The third constant for Colombia emerald formation and producing oil fields are the two periods of significant fault and tectonic deformation. The Pacific tectonic plate subduction under the Colombian landmass occurred in two easterly directed deformation pulses; occurring at 65 MM years ago for the eastern flank of the emerald belt (Chivor) and at 35 MM years ago for western emerald belt (Muzo). The deformation pulses produced high temperature and pressure events leading to the emerald crystal occurrences. Outcrops and oil wellbore cores contain evidence of numerous fracture types which are the pathways for emerald bearing fluid movement .

Colombian Emeralds are formed in the complex interplay of (1), elementally-enhanced, oil source rocks mixed with (2), the mineral rich fluids generated from the underlying evaporite/halite beds and (3) are then deeply buried under high temperature and pressure conditions. These emerald host rocks are then tectonically uplifted, faulted and folded into the present-day topography.

From field trips by helicopter and 4-wheel drive vehicles; numerous hot and humid hikes; to emerald mine visits; illustrated with specimen photos; to the streets of Bogota; this geological/mineralogical story will take you across the Colombia landscapes. The finest Colombian emeralds are some of the most coveted mineral specimens and fine Colombian emerald jewelry may command princely sums of money.

To bring the presentation home to New Mexico, there is brief discussion of New Mexico's emerald occurrence.

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