

Smoke Treatment in Wollo Opal

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An older treatment has recently been applied to some of the newer Ethiopian, Wollo** crystal opal on the market. Similar in some ways to the Indonesian natural dark hydrophane opal, this material is a hydrophane crystal opal that has been darkened through a smoke process.

Stone Group Labs of Jefferson City, MO was recently presented with samples of a reportedly new find of black opal from Ethiopia. The samples were submitted by Jewelry Television, prior to purchasing a large lot, as part of their protocol testing program.

Black opal is the rarest and most desirable color of opal, as a dark body color sets off an opal's play of color more dramatically. Few places produce black opal, most notably the areas in and around Lightning Ridge, Australia, as well as Mintabie in South Australia. Indonesia produces a very small amount of dark opal, most of which has a brownish (dark tea) color. Shewa, another opal producing area of Ethiopia, also produces brown body colors, but opal from this particular area is notoriously unstable. Honduran opal can have a very black body color, but the play of color tends to have a much smaller pattern size with a more opaque appearance, due to residing in a black basalt matrix.

The new Wollo treated material exhibited fair to bright play of color, predominantly in the red and green colors. The pattern of the color, along with nicely domed cabs, was much like material previously seen from the Wollo district of Ethiopia. General gemological testing initially showed no anomalies in this material, although some showed cracks and crazing that are not commonly observed in Wollo opal. Tests performed include x-ray fluorescence (ED-XRF), infrared spectroscopy (FTIR), and Raman analysis. Still, the black body color was not convincingly natural when taken in context with this lab's experience with opal. The way in which the precise source was not openly disclosed, as well as an unwillingness to provide matching rough material reinforced lingering doubts.

In order to positively confirm treatment, the lab decided to experiment with their own in-house lab samples, subjecting them to various means of adding body color. Eventually, experiments with smoke treatment yielded an identical effect. In retrospect, the uniquely porous character of the Wollo hydrophane opal makes it ideal for this sort of treatment, as the smoke can penetrate into the hydrophane type of opal, yielding an even body color. The dark coloration permeated fairly evenly throughout the stone in samples that were broken open.

Once before and after test samples were available, it was possible to isolate the subtle differences in test results. Raman spectroscopy yielded clear differences in treated and untreated stones. The in-house smoke-treated samples matched the submitted black opal samples. Further, the less than ideal experimental treatment process, exhibited pock marks and smoke concentrations that are visible under magnification. Once these markers were identified as a result of treatment, it was possible to see similar features in the submitted black opal samples.

Gemologists and appraisers should be able to sight-ID this material once they have seen a few, especially if they have sufficient prior opal experience. Laboratories should look for carbon peaks at 1150 cm^{-1} in Raman readings. This Raman peak is known to indicate carbon, such as the amorphous C-C molecular bonding of carbon smoke or burn residues. This peak was consistently present in most smoke treated opals tested, but absent in all untreated opals.

This is the second instance of Ethiopian Wollo opals being submitted to Stone Group Labs as natural black opal this year - and this smoke-treated material was by far more challenging to positively identify. Smoke treatment in opal has been known, but it has not been commonly seen in the market since the early 1980's, when the treatment was applied to some Mexican hydrophane opal. To date, we have not seen natural black opal from Ethiopia, but it is certainly possible that it could exist. The dark body color of some Shewa opals leans toward a brownish black, as does a very small percent of the Wollo material. These are often referred to as "chocolate Opal", due to their brown coloration.

Stability tests to date show the treatment to be stable and durable. The deep penetration of the smoke color allows for repolishing if necessary without losing color. Cleaners and solvents did not alter the color in treated stones.

While the Wollo opal is a comparatively stable opal, we did observe cracking and some crazing, presumed to be a result of the high heat during treatment, but this was observed in less than ten percent of the samples.

This discovery merely confirms that most any treatment can be done to any stone, and this is especially true of hydrophane opal. We would like to thank JTV for their diligence in submitting this material to this lab. Catching this kind of treatment early is essential to maintain confidence in the colored gemstone market, as this material was initially widely represented as natural.

** While most commonly referred to as Wollo, this Ethiopian province can also be spelled/translated as "Welo" or "Wello". Currently, all spellings are considered valid, although Wollo seems to be the preferred spelling among English speakers.

Addendum: Further results of testing and additional photos will be added to this site as available. A well-researched article on Ethiopian Wollo opal appeared shortly after SGL's original release of this treatment information, leading to our assumption that the treatment entered the market after the submission of this ICA article, as it is not mentioned.

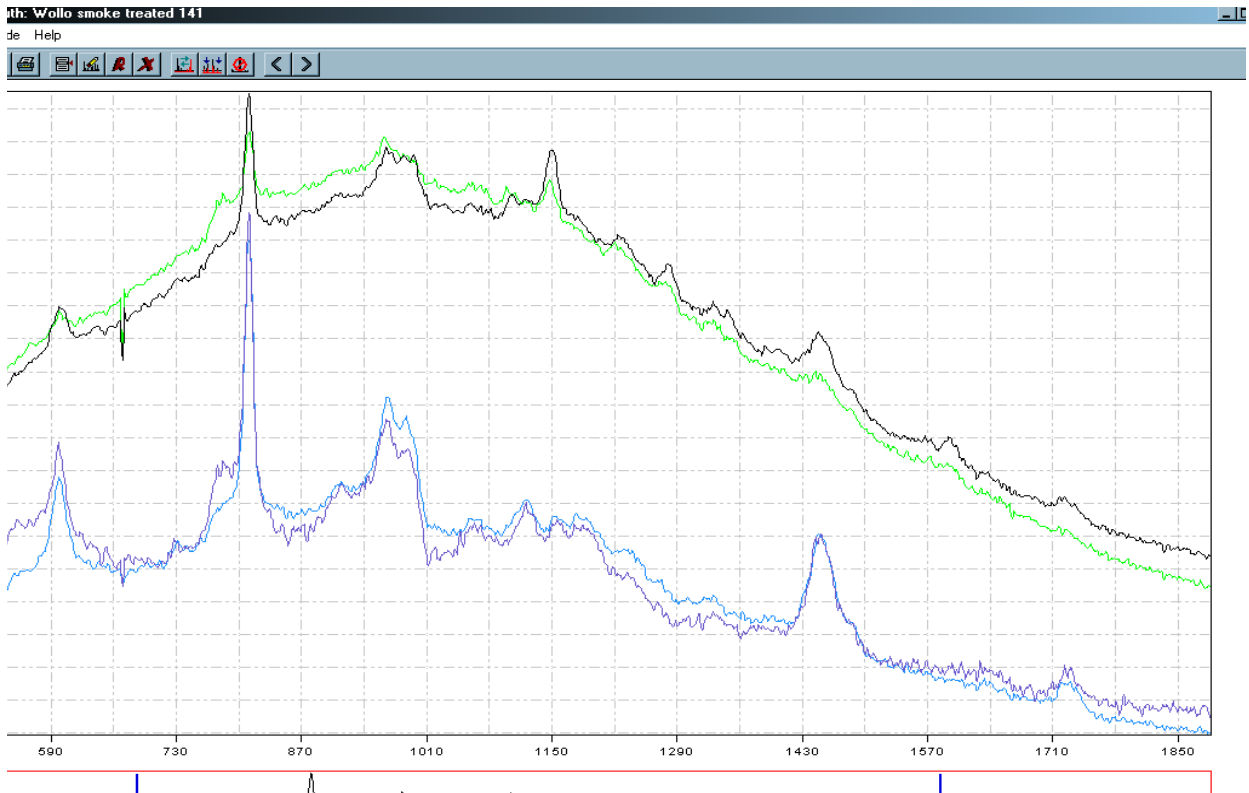
<http://www.gemstone.org/webincolor/Summer2011/index.html>

Following both submissions, researchers at GIA, Carlsbad released results of a different type of artificial coloration in hydrophane opal.

<http://www.gia.edu/research-resources/news-from-research/index.html>.

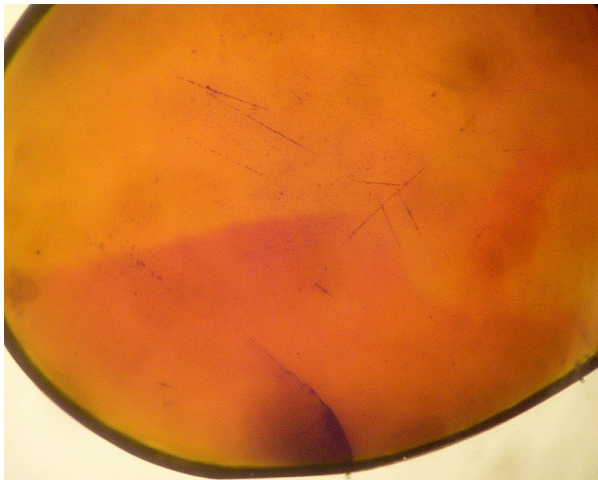
See also a previous release by SGL of an earlier Wollo treatment published in GemWorld's Gem Market News.

Photos and further information:



RAMAN signatures of Wollo smoke treated vs. natural material.
Upper two green & black lines are Wollo Smoke-Treated.
Lower 2 blue lines are Natural Wollo crystal.

The natural Wollo opals show a straighter (more horizontal) reading with higher peaks, whereas the smoke treated opals have more attenuated peaks, as well as having a higher wave due to a general fluorescence effect. This is nearly diagnostic in itself; however, the important indicator here is the formation of the 1150 cm^{-1} peak found in the smoke treated opals. In the literature this peak is attributed to C-C / C-O-C, a carbon phase formation, such as results from soot or smoke residues. Please note: a Raman operator may occasionally experience a fluorescent flooding effect, which will mask all readings.



Backlit opal may show smoke concentration in openings, scratches or cracks

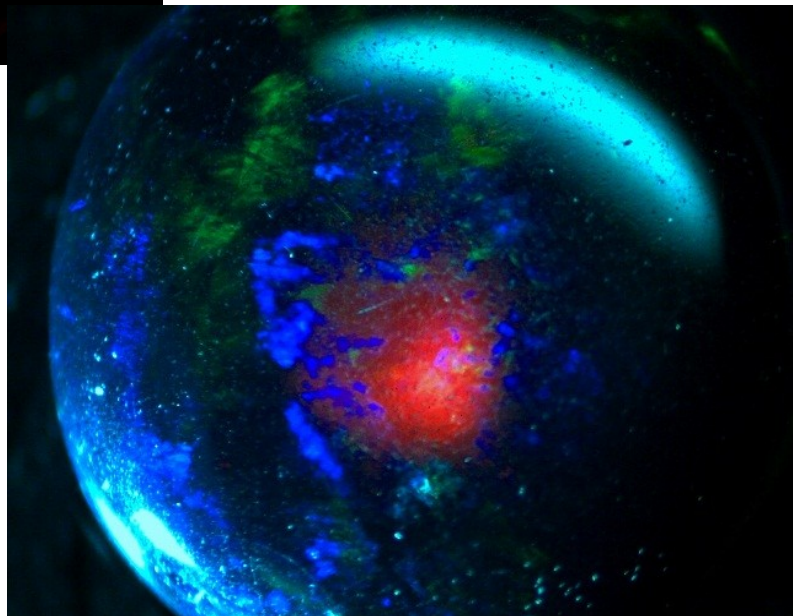


Before & after smoke treatment. These opals originally looked identical in transparency and play of color.



Carbon (smoke) spots inside smoke treated opal.

Surface pitting on reflected surface of treated opal – upper right of photo. This effect is possibly the result of heat and subsequent repolish.





Natural Shewa dark opal rough showing a dark "chocolate" body color.



Smoke-treated Welo



Smoke-treated Mexican hydrophane from the 80's
Stone courtesy Commercial Mineral Company

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