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SPECTROSCOPIC STUDY OF CANADA BALSAM USED AS FILLER SUBSTANCE IN EMERALD

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It is a common practice to fill fractures or voids in cut emerald gemstones to enhance their clarity (KIEFERT et al., 1999; NASDALA et al., 2001). A variety of filler substances is used, ranging from volatile and, therefore, easily removable oils (e.g., oil of cedar wood) to glass and durable hydrocarbons (e.g., epoxy resins). After being applied to the stone, fillers undergo an aging process in the course of which they may even decompose. Because solidified fillers or decomposition products may lower a stone's value appreciably, these substances need to be identified prior to the sale. We have studied a suite of cut emerald stones treated with Canada balsam, and commercial Canada balsams. Even though all Raman spectra show somehow similar patterns of bands in the spectral regions of C-C (below 1700 cm^{-1}) and C-H vibrational modes (at around 2900 cm^{-1}), we found notable differences among them (Fig. 1). It is obvious to assume that Canada balsam is not well defined in terms of its composition. Unambiguous identification of Canada balsam in cut stones is even more difficult because of (1) strong Cr^{3+}-related luminescence of emerald, (2) often a strong broad-band luminescence of the balsam, and (3) changed Raman spectra of balsams that have been applied several years ago already.

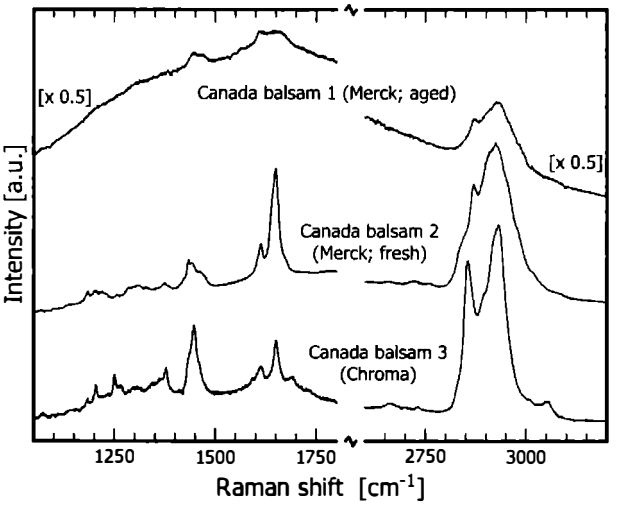

Fig. 1 Three Raman spectra of Canada balsam (stacked). There are already significant differences among spectra of the commercial chemicals (compare 2 and 3). Variations among Raman spectra become even more significant as a result of aging (see the broadening and intensity loss of Raman bands especially in the region below 1700 cm^{-1}). Aging of Canada balsam is often accompanied by a dramatic increase of the background luminescence (compare 1 and 2)

References

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NASDALA, L., BANERJEE, A., HÄGER, T. & HOFMEISTER, W. (2001): Microsc. Anal., Eur. ed., **70**: 7-9.