Chemical classification of emeralds: A framework for discussing the origin of emerald deposits

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Thirty emerald crystals from 13 emerald deposits were analyzed using instrumental neutron activation analysis (INAA). The emerald classification scheme of Giuliani *et al.* [1] is used as the framework for the rationalization of the chemical data.

Logarithmic x-y plots using Cs, Na, Rb, Ga, Fe, Sc, Co, As and Sb, and a three component Cr-Cs-V plot, effectively differentiate the emerald types.

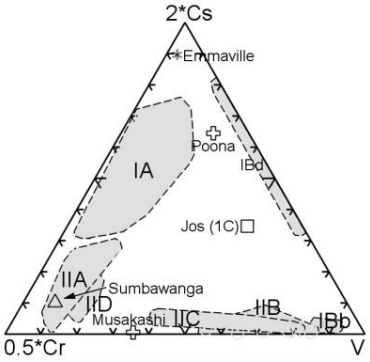

Fig. 1: Cr-Cs-V diagram showing the different emerald groups. Type designations are from Giuliani et al. [1].

Type I, which comprises the largest number of emerald deposits, can be subdivided on the basis of the Cr/V ratio. Rare earth element (REE) data can be used to differentiate between magmatic sources that gave rise to the Type I emerald deposits. High Cs is associated with S-type granite and low Cs with alkaline granite sources for the emerald-forming solutions.

Type IIB emeralds have REE patterns very similar to the host black shales illustrating that this lithology is the source of the emerald-forming solutions.

On all the discriminat diagrams there are two apparent end-members, Type IA and Type IIB. The Type IIA, IIC, and IID emerald deposits tend to plot between these end members. REE and other data indicate a complex interplay between the fluids forming these mineral deposits and the country rock.

[1] Giuliani *et al.* (2019) *Minerals* **9**, 105