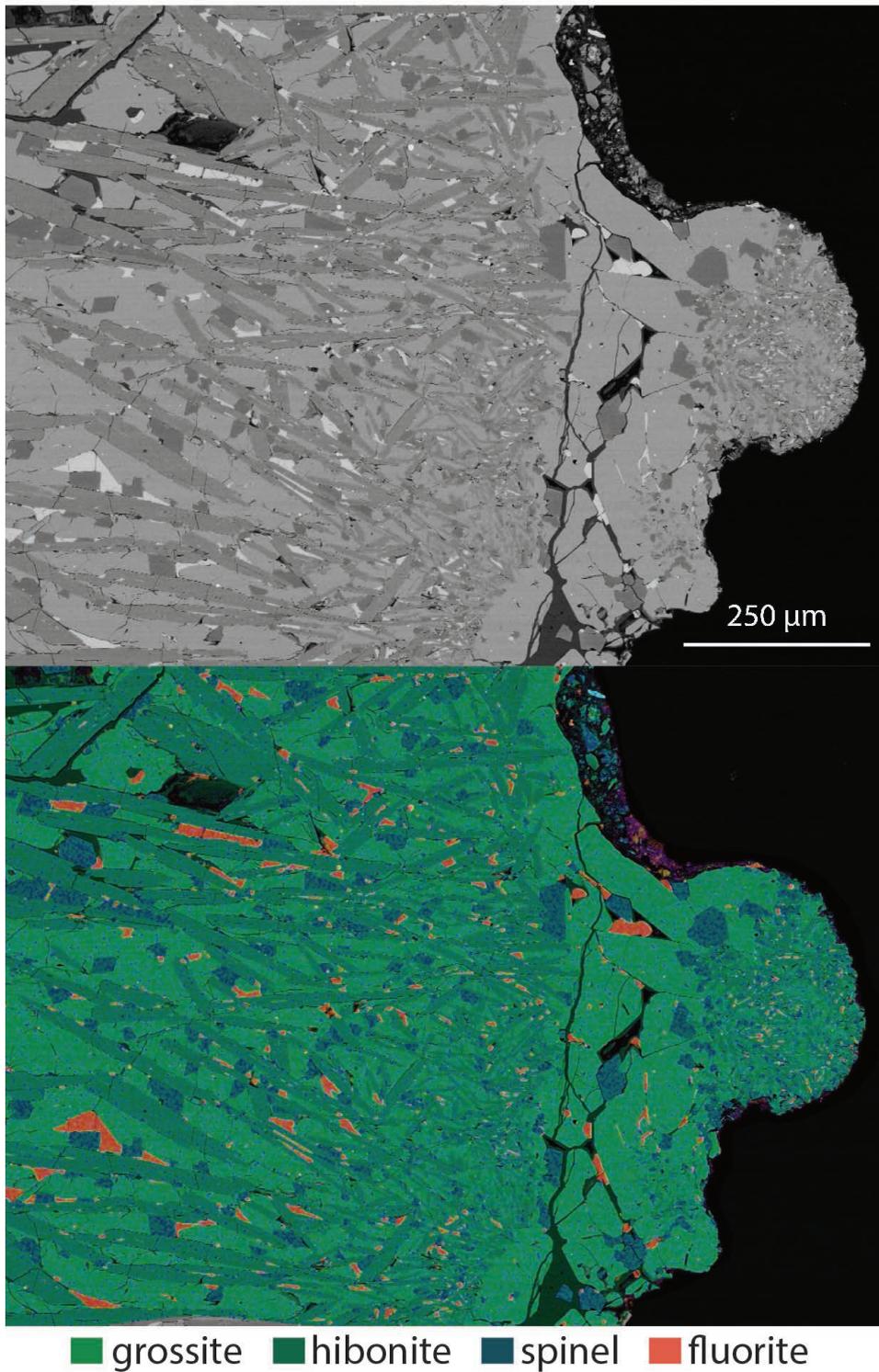
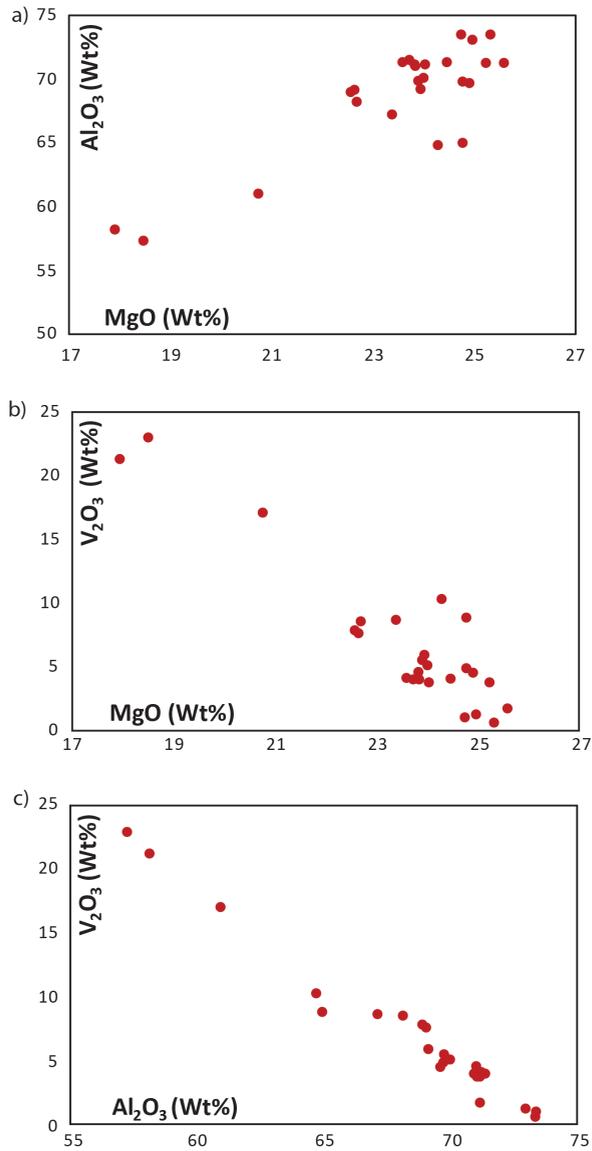


SUPPLEMENTAL FIGURE 1. Location map showing position of the study area within the Levant-Arabia context (a) and geological map (b) with sample localities. Volcanic centers on Mt Carmel are marked by yellow dots.

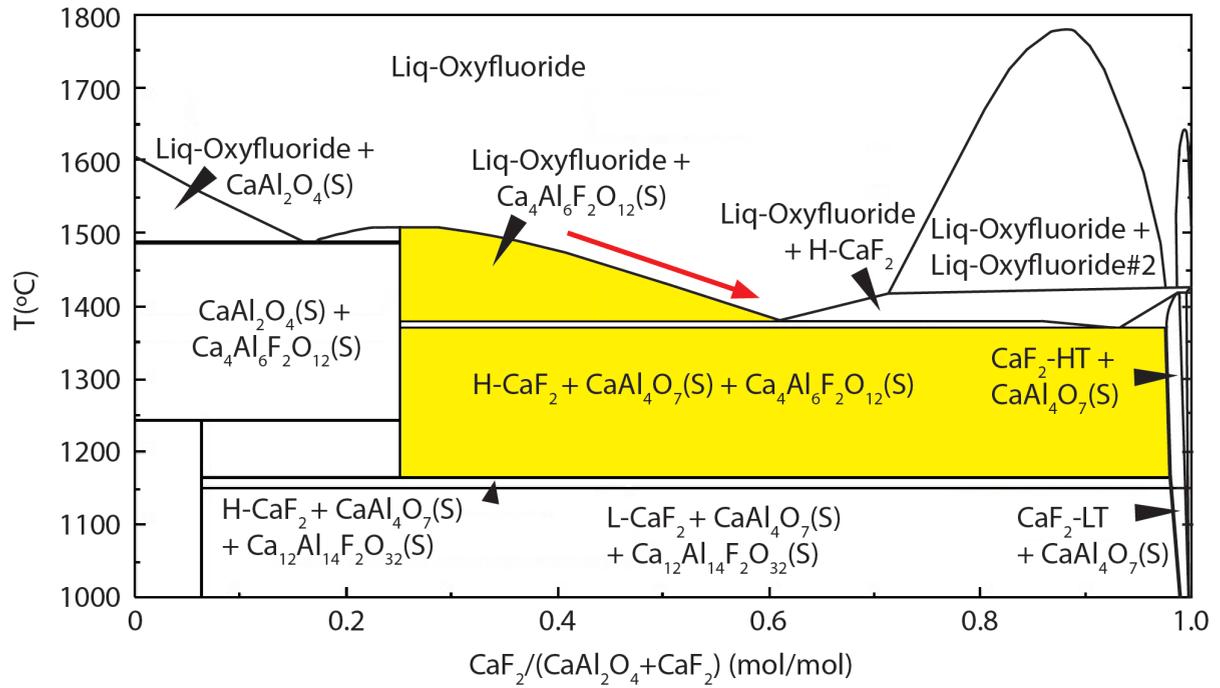


SUPPLEMENTAL FIGURE S2. Aggregate showing apparent quench structure; thin hibonite tablets radiate from coarse crystals of grossite + spinel, suggesting crystallization from a substrate into liquid.

SUPPLEMENTAL VIDEO S3. 3D-CT video of vanadium dendrites in hibonite crystal. Red-orange = vanadium; green = open cavities. (see zip file)



SUPPLEMENTAL FIGURE S4. Interelement correlations in V-rich spinels of paragenesis B.



SUPPLEMENTAL FIGURE S5. CaF_2 - CaAl_2O_4 binary (after Kim 2011) showing crystallization of $\text{Ca}_4\text{Al}_6\text{F}_2\text{O}_{12}$ from ca. 1500 to 1390 °C, and instability of $\text{Ca}_4\text{Al}_6\text{F}_2\text{O}_{12} + \text{grossite} + \text{CaF}_2$ below ca. 1150 °C. Red arrow shows possible evolution of the late melts in the hibonite-grossite-spinel aggregates.