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Mineralogy of Selected Samples from Hicks Dome, Hardin County, Illinois

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Hicks Dome is a deep fluorite-barite deposit in the Illinois-Kentucky fluorspar district in Hardin County, Illinois. This is a mineralogical study, conducted in 2010, includes X-ray diffraction (XRD), reflected light microscopy (RLM), transmitted light microscopy (TLM), scanning electron microscopy (SEM), and energy dispersive spectroscopy (EDS) of four drill core samples. These samples are composed primarily of 10-50% fluorite, 5-15% Sr-bearing barite, 10-25% fluorapatite, 0-25% dolomite, 5-20% quartz, 10-15% clays (primarily illite), 3-7% Nb-bearing brookite, and 1-4% Nb-bearing anatase. Pyrochlore is present in amounts up to 4% pyrochlore, along with 0-1% xenotime, and 0-2% brabantite. Trace amounts of Ba-bearing celestite, calcite, pyrite, chalcopyrite, galena, and possibly britholite are also present. Some of the fluorapatite is Y-bearing and rare earth element (REE)-bearing, and some clays are Y-bearing. Large grains of fluorite are free of inclusions, some fluorite is rimmed by fluorapatite, and much of the fluorapatite is intergrown with fluorite. Fluorapatite is very fine-grained and much of it is intergrown with fluorite. Most barite is free of inclusions, except for large grains that have been partially or mostly replaced by fluorite and/or dolomite that contain chalcopyrite and pyrite inclusions. Brookite and anatase are Nb-bearing, subhedral grains. Pyrochlore occurs as very fine-grained prismatic crystals. Xenotime also is very fine-grained. When present, brabantite rims xenotime. REE are critical to energy as they are essential for permanent magnets in wind turbines and EV motors. Y is used as an additive in alloys to increase the strength of Al and Mg alloys, in microwave filters for radar, and as a catalyst. In addition to having superconductor properties, Nb is used to strengthen stainless steel alloys in jet engines and rockets, oil rigs, and oil and gas pipelines. Due to its strength and light weight, Ti is used in nuclear submarines, atomic energy icebreakers, and aviation equipment.