Field Observations of Magmatic Silica Caps in Over-Pressured Felsic Cupolas: Evidence for the Magmatic to Hydrothermal Transition

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Diagnostic textures related to over-pressured volatiles and fluid saturation observed in felsic cupolas such as unidirectional solidifications textures (UST's), stockscheider, plumose feldspars and miarolitic cavities are relatively common and well-described in the literature. Field observations indicate that massive accumulations of magma-derived silica may also be present at the roof zones of cupolas forming a "silica cap". Furthermore, those silica-enriched zones (intergranular space, discrete layers, sills and dykes, massive bodies) may transition to an underlying comb quartz UST horizon reflecting magma quench processes due to undercooling and oscillatory crystallization of excess silica during the magmatic to hydrothermal transition. These do not appear to be well documented in the literature, perhaps due to lack of recognition or destruction by overprinting late-magmatic or hydrothermal events. Silica caps have been recorded in a variety of felsic cupolas, some of which are associated with intrusion-hosted mineral deposits, including porphyry copper systems. These include REE deposits at Jabal Umm Al Suqian in Saudi Arabia, the giant tungsten deposit at Panasquera in Portugal, the tin-copper porphyries in the Erzgebirge in Germany, intrusion-related gold deposits at Tsagaan Chuluut in Mongolia and Ravenswood in Australia. Examples for porphyry copper systems are Maria in Mexico, Didipio in the Philippines, Briggs in Australia and Tsagaan Survaga, Khongor and possibly Oyu Tolgoi in Mongolia, and Saginaw Hill in Arizona. In some cases, where the volatile over-pressuring continues post the deposition of the silica cap then hydrothermal breccias with barren magmatic silica clasts and matrix sulfides may form; good examples being the quartz breccias at Maria and Didipio. While most cupola-related magmatic silica caps pre-date sulfide mineralization, together with outcropping UST's zones, they are useful exploration vectors for porphyry copper and intrusion-related mineral systems. In addition, at the district scale, they provide clues as to levels of erosion within intrusion complexes.