The hypothesis that porphyry copper deposits are linked to active volcanoes is examined in the light of recent advances in understanding silicic volcanism in arcs. PCDs are commonly associated with silicic and intermediate composition dykes and plugs, which can be explained as volcanic conduits related to lava dome and explosive activity. Models of PCD’s commonly envisage steady degassing of large silicic magma chambers, in recognition that the small porphyry intrusions cannot provide the very large volumes of magmatic fluids needed to explain the localised enrichments in metal sulphides. However, evidence from well-documented active arc volcanoes indicates that they are highly unsteady systems. Arc volcanoes commonly alternate between very long periods of dormancy (typically > 10^3 to 10^5 years) and short intense bursts of activity (typically 1 to 10^3 years) when evolved volatile-rich magmas are transferred from the lower and upper crust to form ephemeral magma chambers. The short periods are associated with volcanic activity characterised by cyclic dome growth and explosions. There is large variation of the flux of magma and volatiles, but these fluxes can be de-coupled. There are examples of arc volcanoes where magma eruption and volatiles are well correlated, cases where volatiles degas between cyclic episodes of dome growth and explosions, and cases where there is persistent magmatic degassing without eruption of magma. The compositions of the magmatic volatiles reflect associated variations in depths of degassing. During the short periods of volcanic activity the magmatic systems are disturbed and magma mixing is common as magmas derived from different depth intermingle. Magmatic fluids typically have multiple sources, have different degassing solubility-controlled behaviours of volatile species (notably H_2O, H_2S, SO_2 and Cl) critical to ore formation, and can decouple from parent magmas in space and time. The water content of arc magmas is typically significantly higher than previously thought with values of 4% typical of primitive arc basalts, while andesites and rhyolite melts derived from these basalts by differentiation in the lower and middle crust may commonly exceed 10%. Thus degassing starts much deeper than commonly supposed and this is supported by geophysical observations of deep sources of SO_2 (> 10 km). Magmatic volatiles can originate in three different ways: from shallow degassing of silicic magma chambers; from ascent of deeper more mafic magmas during system disturbances during eruptions; and by segregation and long term storage of deep poorly soluble volatiles in the lower and middle crust. The release of these volatiles from all these sources can occur on very different time scales and volatiles become decoupled from magma. We propose that PCDs form during the short bursts of volcanic activity when sub-volcanic intrusions disrupt the
upper crust to enable magmatic fluids from different depths and sources to flow to the surface and intermingle. This hypothesis is consistent with emerging evidence of multiple short-lived bursts of mineralization in PCDs.