A PHYSICO-CHEMICAL ASSESSMENT OF THE POTENTIAL RESPIRATORY HEALTH HAZARD OF QUARRIED VOLCANIC DEPOSITS

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The potential respiratory health hazard of volcanic ash is routinely studied but little is known about the respiratory hazard of quarried volcanic deposits, either as loose, clastic deposits or freshly blasted lavas. Quarrying of both deposit types may expose workers to fine particulate and subsequent processing of material may reactivate particle surfaces, thereby affecting their potential toxicity.
Here we explore whether quarried volcanic particulate can potentially cause respiratory disease; either through reactivated surfaces on aged deposits or formation of new particulate from blasted lava which might pose a similar hazard to fragmented, erupted ash. Such quarrying is of economic importance and here, samples collected from New Zealand (tephrite, trachybasalt, basaltic andesite, dacite and rhyolite), Montserrat (andesite) and Greece (rhyolite) are presented. Grain size analyses of particulate generated from solidified lava flows indicated that the finest particles were produced as a result of drilling (carried out prior to blasting); however, in all magma types, processed (finished) product also contained significant quantities of respirable material. SEM analyses confirm that the morphology of particles can be altered by the method of processing. Crystalline silica quantification was determined by XRD and showed that the Montserratian samples contained the greatest quantities (up to 16 wt.% quartz), with the basaltic and rhyolitic samples containing much lower levels. Preliminary surface reactivity analyses indicate a trend between magma type and hydroxyl radical generation, with magmas richer in iron generally generating more radicals. Further surface reactivity tests and leachate experiments are currently in progress. This trans-disciplinary research will incorporate mineralogical characterisation with risk assessment of the quarries visited, providing them with information useful for potentially shaping policy on occupational exposure.

Keywords: volcanic, health, hazard