Submitted Abstract

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Abstract

Glaciers have previously been seen as pristine environments. However, research has shown that glaciers can accumulate and store contaminants in cryoconite, an organic-rich sediment found on the surface of glaciers. Numerous anthropogenically and naturally-derived contaminants have been found globally within cryoconite, including fallout radionuclides, potentially toxic elements, and heavy metals. The introduction of these contaminants can come from human activities such as the use of agricultural fertilisers, carbon-based industries, vehicular use, and nuclear power plants. However, these contaminants can also originate from natural sources such as erosion of metal-rich rock and forest fires. Through glacier change, recession, and melting events, these contaminants are remobilized into glacial riverine systems and downstream environments. This can then pose risks to downstream populations who rely heavily on glaciers for meltwater, as well as fragile ecological habitats and ecosystems.

When assessing potential downstream risk from glacial contaminants, it is crucial to know what types of contaminants may be released in meltwaters and in what quantity. Here we identify contaminants within cryoconite from glaciers in Peru's Cordillera Blanca. Previous studies have shown that glaciers in similar environments (i.e. high mountain glacier catchments) have been found to contain differing types and concentrations of contaminants within cryoconite. However, until now this had not been reported for cryoconite on glaciers in Peru.

This research investigates the variation in contaminant load in cryoconite from four different glaciers (Pastoruri, Shallap, Vallunaraju, and Yanapacca), which all feed into the Rio Santa, Peru. Key contaminants in cryoconite from this region have been quantified and analysed using X-ray fluorescence, gamma spectrometry, and ICP-MS. The bioavailability of these contaminants has also been assessed using a BCR sequential extraction procedure, to determine possible impacts from their release into meltwater. These combined results contribute to an improved understanding of the extent to which glaciers may act as a secondary source of contaminants within the Andes and similar mountainous environments. This is an important first step towards assessing the risk of contaminant release from glaciers in mountain regions.