Abstract ID : **334**

Volcanic Eruptions as a Major Source of Perchlorate in the Environment

Content

Perchlorate (ClO4⊠) is ubiquitous in the environment. Scientific and societal interest in environmental perchlorate is strong owing in part to the significant risk perchlorate exposure poses to human health. Ultimate sources of environmental perchlorate include the release from industrial production and usage of perchlorate salts in a variety of applications and natural formation. Recently constructed ice core records of environmental perchlorate have shown that perchlorate levels have increased significantly since 1980, probably as a result of significant anthropogenic emissions of chlorine compounds. Prior to 1980, natural chemical formation from commonplace chlorine species in the environment is considered to be the only significant origin of environmental perchlorate. Careful examination of a 300-year perchlorate record from a Greenland ice core indicates that episodic explosive volcanic eruptions are a significant source of natural perchlorate, comprising on average about 40% (0.16 ⊠g m⊠2 yr⊠1) of the total yearly natural perchlorate flux (0.39 ⊠g m⊠2 yr⊠1). Currently prevailing understanding of natural perchlorate formation is probably via oxidation or chemical transformation of chloride in the atmosphere, the most common and stable chlorine species in the environment. Available ice core data suggest that (1) perchlorate is formed in the atmosphere, rather than directly emitted by volcanic eruptions, (2) at least some of the perchlorate is formed in the stratosphere, and (3) only chemical processes unique in the stratosphere, rather than the processes in the troposphere or the type of perchlorate precursors from eruptions, are affected by eruptions directly injecting aerosols and gases into the stratosphere. As ozone is an important hypothesized precursor of perchlorate, the ice core data suggests that variations of perchlorate levels in polar snow, accessible with ice cores, are probably related to ozone variations and therefore hold the potential for the reconstruction of ozone records on decadal, centennial, and millennial time scales.

Primary author: COLE-DAI, Jihong (South Dakota State University, SD USA)

Co-authors: FERRIS, Dave (Dartmouth College, NH USA); COX, Thomas (Butte College, CA US A); KARI, Peterson (South Dakota State University, SD USA); KENNEDY, Joshua (South Dakota State University, SD USA)

Presenter: COLE-DAI, Jihong (South Dakota State University, SD USA)

Track Classification: Progress in proxy development and interpretation