**A method for preventing large eruptions**

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The most sever risks to human life on Earth are classified as catastrophic and existential. A catastrophic risk is an event or scenario that has the potential of destroying modern civilisation, whereas an existential riskis an event or scenario that could result in the extinction of humankind. Very large volcanic eruptions (of the order of 1000 km3) pose catastrophic risk, and some even existential risk, to humankind.

A common view is that there is nothing which we can do to prevent large eruptions – or volcanic eruptions in general. Instead the focus has been on how to mitigate their effects on human lives and properties. Mitigating the effects of eruptions is certainly worthwhile, but unlikely to be of much use for very large eruptions. Eruptions with volumes of the order of hundreds or thousands of cubic kilometres potentially affect so large areas – some the entire Earth – that mitigation methods are not likely to be of great value. The question then arises: are there any ways to prevent large eruptions form happening? Here outline a method that could be of use.

The method is called hydroshearing and aims at gradually decreasing or transforming the accumulated elastic energy in the volcano through slip on existing fractures/faults. Hydroshearing has a long history in Enhanced Geothermal Systems (EGS) – also known ashot-dry-rock systems.In order to prevent eruptions, hydroshearing is here used to form a stress barrier or a seal in the roof close to the magma that prevents magma-chamber rupture and dike injection; or, alternatively, if the hydroshearing is carried out in a shallow layer or unit, to prevent an injected dike from reaching the surface.

More specifically, hydroshearing triggers numerous small fault slips (and earthquakes), thereby minimising the stress difference in the chamber roof – or any layer to which the method is applied. Hydroshearing thus brings the state of stress in the roof/layer closer to lithostatic, whereby all the principal stresses are the same and equal to the overburden pressure. For a lithostatic state of stress, there is no tendency to brittle deformation, either through faulting or dike/sheet injection. Thus, hydroshearing transform the roof/layer into a stress barrier, a seal, that prevents dike/sheet injections and, thereby, eruptions.

Theoretically, the stress barrier or seal can be maintained as long as we wish.Replenishment or refilling of a magma chamber is normally a slow process, resulting in a low strain rate. To maintain a stress barrier condition in the roof of a large chamber many EGS reservoirs are normally needed. The reservoirs can supply hot fluids to geothermal power plants that could be operative for many decades or possibly several centuries, making the method economic in addition to preventing large eruptions.

Gudmundsson, A., 2020. *Volcanotectonics: Understanding the Structure, Deformation, and Dynamics of Volcanoes.* Cambridge University Press, Cambridge.