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*'Understanding volcanoes and society: the key for risk mitigation'*



## **Affordable technology for monitoring remote volcanoes.**

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Half of the volcanoes in eruption in the next century are expected to reawaken after a repose interval of 100 years or more. Most are unlikely to be monitored and their populations unaware of the hazards they pose. Most will also occur in nations that have limited economic resources for the long-term monitoring of volcanoes. Advances in technology are yielding opportunities for designing and deploying affordable sensors for the real-time acquisition of essential geochemical and geophysical signals of volcanic unrest. Here we present preliminary results from Project Volcalarm, a new Anglo-Italian initiative for low-cost sensor development. The first miniaturized sensors are being designed to monitor volcanic degassing. They consist of a commercially-available CO<sub>2</sub> detector and bespoke components for converting the data into a digital signal. Gas concentrations are measured by Non-Dispersive Infrared (NDIR) spectroscopy. For the pilot instruments, the data are stored locally on a micro-SD card, but this can be substituted with a wireless transmission system for relaying data to remote locations. The detector has a total detection range of 0-10 000 ppm and notional lifetime of at least 15 years. The new sensor has been initially tested for CO<sub>2</sub> degassing at several locations in the Campi Flegrei caldera, west of Naples in southern Italy, including the Bocca Grande fumarole at Solfatara, which is used for diagnostic monitoring of gas release from the caldera. Measured CO<sub>2</sub> concentrations agreed well with those from the standard MultiGAS monitoring instrument, which is designed for manual, spot measurements of degassing. Compared with the MultiGAS equipment, the new sensors are lighter, simpler to operate and significantly less expensive. They require minimal maintenance and, instead of spot measurements, provide for continuous data recording, storage and transmission. They are thus well-suited for deployment in a long-term, volcano-wide monitoring network in remote locations.