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When the Earth speaks

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Earthquake forecasting has been an elusive goal for a long time, not only for seismology. Yet, before major earthquakes, the Earth appears to sends out signals. Most signals point to transient electric currents in the Earth's crust. To search for the cause of such currents attention has focused - for decades, but in vain - on piezoelectricity, a property of quartz, an abundant mineral in certain rocks. The fact that no generally accepted, physics-based mechanism for the generation of large currents was available has caused considerable confusion and controversy. During rock deformation studies we have made an amazing discovery: when we squeeze one end of a 1.2 m long slab of granite (or quartz-free rocks such as anorthosite or gabbro) the stressed rock volume generates a voltage which in turn causes two outflow currents. One, carried by electrons, flows from the stressed rock directly to ground. The other, carried by defect electrons or holes, flows into and through the unstressed rock and out the other end. The stressed rock behaves, in fact, as a battery. The outflow currents can reach 10,000-100,000 amperes per cubic kilometer of stressed rock. The discovery of this previously unknown capacity of igneous rocks to generate currents offers for the first time a physical basis to re-evaluate a wide range of reported pre-earthquake signals as potential indicators of impending earthquake activity.