Geophysical Research Abstracts, Vol. 9, 10743, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10743

The rock-physics interpretation of seismic tremor under the subduction zones

Luigi Burlini (1), Giulio di Toro(2), Philip Meredith (3)

1) Institute of Geology, ETH, Leonhardstrasse, 19, CH- 8092, Zurich, Switzerland

2) Dipartimento di Geologia, Paleontologia e Geofisica, Università

3) Department of Earth Sciences, UCL, Gower Street, London.WC1E 6BT United Kingdom.

We have measured the output of seismicity, as acoustic emission (AE), during heating of serpentinite samples to beyond their equilibrium dehydration temperatures.

Experiments were performed on 30mm long cores with a diameter of approximately 15mm, under a hydrostatic stress of 200 and 300 MPa in a Paterson high-pressure/high-temperature internally-heated gas apparatus. AEs were recorded via two piezoelectric transducers embedded in the sample end caps, away from the hot zone at the ends of two hollow zirconia buffer rods. Drained and undrained conditions were achieved by placing either permeable or impermeable discs between the samples and the buffer rods.

At 200 MPa, serpentinites dehydrates to talc + olivine and water around 500 ^{0}C. Microseismicity in the form of high-energy AE events was confined to a narrow temperature interval just above the equilibrium dehydration temperature. This overstep is due to the heating rate being faster than for equilibrium studies in our experiments. The high-energy AE events were characterised by very long duration, which is typical of a cascade of multiple overlapping events that cannot be individually resolved.

Under drained conditions, the serpentinite samples showed a clear volume reduction due to the dehydration reaction and subsequent compaction. By contrast, under undrained conditions, the samples maintained the same dimensions, but lost weight, implying that no compaction occurred during dehydration.

Our results conclusively show that seismicity can be generated by dehydration reactions even in the absence of a deviatoric stress. This has potentially important im-

plications for earthquake nucleation in subducting lithospheric plates. Moreover, the cascade of events that followed the onset of dehydration may well be related to the low-amplitude long-duration (tremor) seismic events that characterize the seismic activity in subduction zones and has been tentatively interpreted as caused by dehydration of the subductiong plate. Support to this hypothesis comes from our laboratory observation where low-amplitude and long-duration events were correlated with the flow of water outside the sample through the porous spacers and the thermocouple holes.