



TEMPORAL CHANGES OF V_p/V_s RATIOS IN THE VOLCANO-TECTONIC SEISMIC SWARM ZONES OF REDOUBT VOLCANO, ALASKA

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It is known that the P and S wave velocity ratio, V_p/V_s , reflect the physical and chemical properties of medium including temperature, density, and rock composition. Temporal variations of V_p/V_s ratios in volcanic regions may allow us to infer the changes in medium and magma properties beneath volcanoes. Redoubt volcano is an active volcano that is located at 175 km southwest from Anchorage. The size of volcano is about 10 km in diameter, and the volume is around 30-35 km³. The volcano has erupted several times since 1902, and most recently in 2009. The eruptions were generally explosive, and produced lava and pyroclastic flows. Seismic events in the volcanic seismic swarm zones of Redoubt volcano are well monitored by Alaska Volcanic Observatory (AVO). We investigate the V_p/V_s ratios in the VT seismic catalogue. Seismic data with high signal-to-noise ratios for earthquakes with epicentral distances less than 10 km are selected for analysis. A total of 6425 P and S travel-time pairs is collected. The V_p/V_s ratios are estimated using a modified Wadati method that is based on the S-P differential travel times versus P travel times. The VT seismic swarm zones are discretized by 0.1°-by-0.1° cells. Tomographic V_p/V_s ratio models are calculated before and after the recent eruption. The average V_p/V_s ratio of the study region is determined to be 1.90, which is significantly higher than that of Poisson solids. Also, systematic temporal changes in V_p/V_s ratios are observed around the volcano before and after the eruption. (Figure 1).

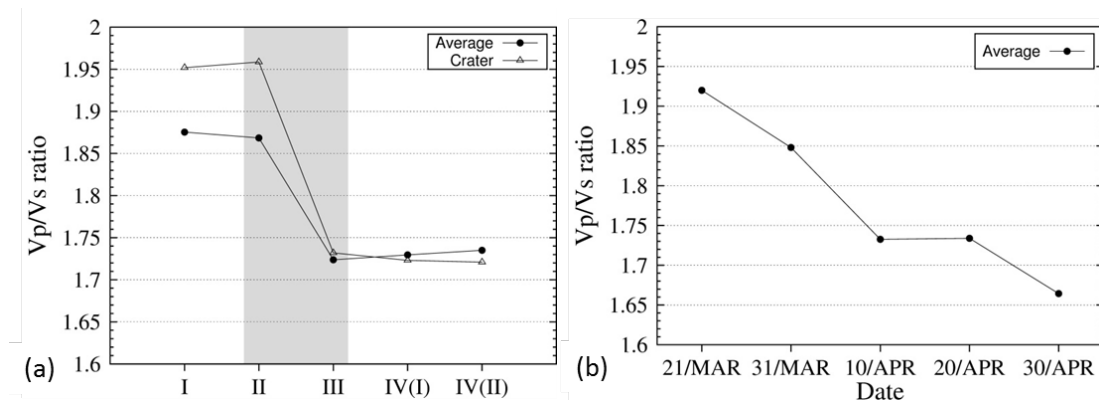


Figure 1. The variation of V_p/V_s ratios with time. (a) Closed circles indicate average of V_p/V_s ratios near the Redoubt Volcano. Open triangles indicate V_p/V_s ratio of the surrounding crater. (b) The variation of V_p/V_s ratios with 10 days during the period of decreasing V_p/V_s ratios abruptly.

The observation suggests that changes in V_p/V_s ratio may be related to changes in the physical and chemical properties of the medium, such as density, temperature, and partial saturation of rocks.

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