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赤外・ラマン分光および熱分解 GC/MS を用いた断層中の炭質物変化の検出
Changes in carbonaceous materials from the fault rock detected by IR-Raman spectroscopies and Py-GC/MS

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To understand the mechanism of fault lubrication during the 1999 Taiwan Chi-Chi earthquake, we developed a new temperature proxy for carbonaceous materials by using infrared and Raman spectroscopies together with heating and friction experiments. We found marked anomalies in the infrared and Raman spectra of carbonaceous materials retrieved from the primary slip zone of the earthquake: the infrared spectra exhibited very weak aliphatic CH2 and CH3 peaks and aromatic C=C absorbance peaks, and the Raman spectra exhibited very weak disordered and graphitic bands and a high ratio of disordered band area to graphitic band area. Those weak peaks and bands and the band area ratio were reproduced by heating carbonaceous materials from the nearby host rock to 700 C. These results suggest that the frictional heat in the slip zone reached approximately 700 C. We characterized the host rock carbonaceous materials by means of elemental analysis, pyrolysis?gas chromatography?mass spectrometry, and simultaneous thermogravimetry?differential scanning calorimetry and found that the H/C and O/C ratios were 0.108 and 0.400, respectively (which are close to the ratios for lignin) and that the volatile fraction was as high as 48 wt %. The pyrolysates obtained by heating from 100 to 400 C were dominated by phenols, fatty alcohols, and n-alkanes. When the residue from pyrolysis at 100?400 C was rapidly heated to 700 C, the resulting pyrolysate was dominated by phenols, aromatic compounds, heterocyclic compounds, and n-alkenes. This information suggests that changes in the infrared and Raman spectra with increasing temperature may have been due to decomposition and aromatization reactions during pyrolysis. Rapid heating during earthquake slip may promote reactions of carbonaceous materials that are different from the reactions that occur during long-term metamorphism.

キーワード: 炭質物, 赤外分光, ラマン分光
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