SEISMIC ACTIVITY, CRUSTAL HIGH CONDUCTIVITY AND THE ROLE OF CARBON DURING SHEAR DEFORMATION

PAUL W.J. GLOVER 1, Antal Ádám 2

1. Université Laval, Québec, Canada, e-mail: paglover@ggl.ulaval.ca
2. Geodetic and Geophysical Research Institute, Hungarian Academy of Sciences, Sopron, Hungary, e-mail: adam@ggki.hu

Well-interconnected grain-boundary carbon in the form of graphite is one of a group of mechanisms that probably contribute to the high levels of electrical conductivity in the lower crust. However, grain-boundary carbon would also be expected to reduce the shear strength of the rock. We report the combination of magneto-telluric field measurements with laboratory-based triaxial deformation experiments to show a correlation between the behaviour of the electrical properties and mechanical properties of carbon-bearing rocks. The magneto-telluric field measurements, which were carried out in Transdanubia (Hungary), indicate a correlation between zones of high electrical conductivity, earthquake focal depths, and zones of high seismic attenuation. The laboratory triaxial deformation experiments show progressive shearing of a fracture in carbon-bearing rock can result in a weaker more electrically conductive fracture. Highly anisotropic conductivities in the crust not only correlate well with zones of crustal weakness, seismicity and high attenuation, but may indicate the presence of feedback mechanisms in which the presence of carbon helps lubricate a failing fault while improving the conductivity along it by a smearing mechanism. These results provide strong evidence for the role of carbon at depth in both electrical conduction and seismo-tectonics, explaining the correlation between mid-crustal high reflectivities and high conductivities observed at many locations worldwide.

Earthquakes, magneto-telluric measurements, laboratory deformation

Paul Glover, Département de Géologie et de Génie Géologique, Université Laval, Québec (QC) G1R 3A9, Canada, tel: +1 418 656 5180, fax: +1 418 656 7339, e-mail: paglover@ggl.ulaval.ca