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Electrical resistivity structure of the Remiremont-Epinal-Rambervillers migrating seismicity zone from magnetotelluric exploration

S. Bourlange (1), P.-A. Schnegg (2) and M. Conin (1)

(1) Centre de Recherche Petrographiques et Géochimiques, CNRS, Vandoeuvre-les-Nancy, France, (2) Institut de Géologie et d'Hydrogéologie, Université de Neuchâtel, Switzerland

A magnetotelluric survey was conducted in the French Vosges Massif. The Remiremont-Epinal-Rambervillers region is a seismically active area situated at the transition between the Paris Basin and the Vosges hercynian massif 80 km Westward from the Rhine graben. One of the most damaging earthquake known to have occurred in France, with a MSK intensity of I_0=VIII took place in Remiremont in 1682. Since 1980, several earthquakes of moderate magnitude occured in this area. A systematic migration of the seismic events was noticed along a nearly North-South direction, and interpreted as the result of the propagation of transient pore pressure changes along a zone of low permeability, presumably a buried fault in the hercynian basement (Audin et al., 2002).The magnetotelluric survey was conducted in order to test if the presence of fluids could be detected along this suspected blind fault, and also to test the possibility of fault fluid content variations along its strike.The obtained data were inverted to get an apparent resistivity model along the fault. The obtained model reveals the presence of resistivity anomalies that could reflect the presence of fluid pressure dilating a fault or a fault network in the basement. Earthquakes location and revealed high conductivity anomalies present a strong correlation. The comparison of the earthquakes migration pattern and the resistivity image allows to estimate a fluid migration rate in the order of 1-10 km/yr. A corresponding basement fault permeability in the order of 10^{-13}-10^{-16}m^{2}is then estimated.This study reinforces the presumption of the presence of fluid in the fault system, and of a correlation between earthquakes occurence and fluid migration in this fault system.