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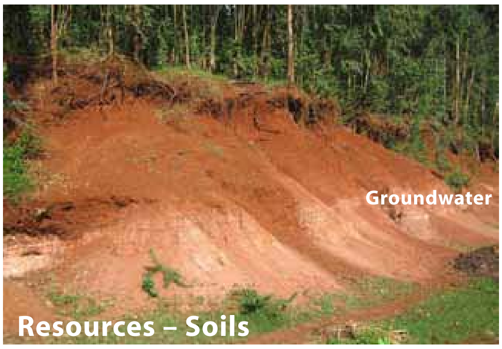
"Challenges for the Planet: Earth Sciences' Perspective"



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and paleoseismic data. Usually the recurrence model is assumed to be Poissonian, but if enough data are available, time-dependent models are also possible;
- Determination of appropriate ground-motion model ("attenuation law") for the region, describing ground acceleration in function of earthquake magnitude and distance.

With these elements we can calculate the maximum ground motion, usually peak ground acceleration (PGA), which can be expected at a given site for a certain return period. Eurocode 8, a European standard for the design of earthquake-resistant constructions which will be adopted in all the member states of the EU in 2011, recommends a reference return period of 475 years. This is equivalent to a probability of exceedance of 10% in 50 years, the expected life span of an ordinary construction. The corresponding reference PGA is calculated at a national level based on the variation of seismic hazard with geographical location within the territory. Based on this calculation, the national territories are subdivided in seismic zones, in which the reference PGA is assumed to be constant.

The zonation map in the Belgian national annex to Eurocode 8 is based on a PSHA study by Leynaud et al. (2000), which made use of their own source-zone model, the earthquake catalog of the Royal Observatory of Belgium (ROB) at that time, and the depth-dependent attenuation law of Ambraseys (1995). In a first step, we reimplemented the PSHA calculations by Leynaud et al. (2000) in two different computer programs, CRISIS and SeisHaz. We also investigated the effect of some unclarified assumptions concerning the truncation of the attenuation-law uncertainty, the cutoff magnitude, and the inclusion of a "background" seismic zone. The reimplementation allowed constructing a new zonation map with finer gradation suitable for the updated version of the Belgian annex. In addition, we conducted new PSHA calculations using the updated ROB earthquake catalog, and two new source-zone models: the seismotectonic model (Verbeeck et al., this volume), and a more simple model consisting of only two zones, the Roer Valley graben and the region outside. We also evaluate the effect of using a more recent attenuation law by Berge-Thierry et al. (2003). The differences in the predicted seismic hazard are small but significant, and increase with longer return periods. The uncertainty associated with the attenuation law has the largest influence. But also the uncertainty on the frequency-magnitude relation for the different zones is found to be an important factor, particularly for regions with relatively low seismic activity. Future PSHA studies should therefore incorporate as much of these epistemic uncertainties as possible in a logic tree.

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Early veining in the Ardenne-Eifel basin (Rursee - Urftsee, Germany): Evidence of tectonic inversion in an overpressured sedimentary basin at the onset of the Variscan orogeny

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Interesting scenarios for fluid redistribution occur during transition between two stress regimes in a sedimentary basin (Sibson, 2004). The tectonically induced transition from an extensional to a compressional stress regime is often accompanied by the increase of pore-fluid pressure up to near- or supralithostatic. These high fluid-pressures are only possible under relatively low values of differential stresses (= σ_1 - σ_3 corresponding with $\sigma_{vertical}$ - $\sigma_{horizontal}$ in an extensional setting or $\sigma_{horizontal}$ - $\sigma_{vertical}$ in a compressional setting) and are thus easier to maintain during the tectonic inversion. As result of these high fluid-pressures, extension (opening mode I) fractures will develop. During increasing tectonic shortening, the differential stress will increase and (extension) shear fractures will develop.

In the frontal part of the Rhenohercynian fold-and-thrust belt, more specific in the periphery of the High-Ardenne slate belt (HASB; Eifel, Germany), two successive types of quartz veins, oriented normal and parallel to bedding, are interpreted to reflect the late Carboniferous tectonic inversion affecting the Ardenne-Eifel sedimentary basin at the onset of the Variscan orogeny. Fracturing and sealing occurred in upper-crustal levels in Lower Devonian siliciclastic multilayer sequences. This study aims at constraining pressure-temperature conditions of both vein types, to be able to reconstruct both regional fluid-system and stress-field evolution in an overpressured basin during the tectonic inversion.

A detailed structural, mineralogical and microthermometric study shows that the bedding-normal veins developed during the latest stages of the Ardenne-Eifel basin development, still reflecting an extensional stress regime. Quartz precipitation occurred in equilibrium with the host rock under low-grade, anchizonal metamorphic conditions with a maximum burial temperature up to 250°C. Quartz commonly occurs as elongated-blocky ataxial crystals (sub)perpendicular to both vein walls. The occurrence of crack-seal host-rock inclusions indicates that these extension veins repeatedly re-opened and sealed. The latter is also evidenced by fluid-pressures, recorded in the fluid inclusions, fluctuating between suprahydrostatic and lithostatic. Quartz veining moreover occurred in a regional consistent stress field under low differential stresses, which controlled a regional quartz vein alignment.

The presence of bedding-parallel quartz veins, mostly at the interface between two lithologies, is the first evidence of the compressional stress regime. Bedding-parallel veins in the periphery of the HASB show a pronounced composite bedding-parallel fabric, consisting of bedding-parallel host-rock inclusion bands and bedding-perpendicular inclusion trails. Quartz crystals show a strong variability in grain size and suffered recrystallisation during progressive veining and subsequent deformation. Micro- and macroscopic observations indicate that some veins in the periphery of the HASB formed due to bedding-parallel thrusting predating the formation of folds and the regional development of cleavage. These bedding-parallel veins reflect a brittle deformation in upper-crustal levels that only can occur under larger differential stresses than previous bedding-normal veining. This shortening is expressed differently in mid-crustal levels in the central part of the HASB where mullions developed (ductile deformation) in between the tips of lensoid bedding-normal early veins.

IMPACT OF THE MEDITERRANEAN OUTFLOW WATER ON NE ATLANTIC SEDIMENTARY PROCESSES AND ECOSYSTEMS

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