Geophysical Research Abstracts
Vol. 17, EGU2015-2629, 2015
EGU General Assembly 2015

Constraints on Long-Term Seismic Hazard From Vulnerable Stalagmites

Katalin Gribovszki (1,2), Götz Bokelmann (1), Péter Mónus (2), Károly Kovács (2), Pavel Konecny (3), Marketa Lednicka (3), Martin Bednárik (4), and Ladislav Brimich (4)

(1) Vienna University, Department of Meteorology and Geophysics, Vienna, Austria (kgribovs@gmail.com), (2) Geodetic and Geophysical Institute, Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, (3) Institute of Geonics, Academy of Sciences of the Czech Republic , (4) Geophysical Institute, Slovak Academy of Sciences

Earthquakes hit urban centers in Europe infrequently, but occasionally with disastrous effects. This raises the important issue for society, how to react to the natural hazard: potential damages are huge, but infrastructure costs for addressing these hazards are huge as well. Furthermore, seismic hazard is only one of the many hazards facing society. Societal means need to be distributed in a reasonable manner - to assure that all of these hazards (natural as well as societal) are addressed appropriately. Obtaining an unbiased view of seismic hazard (and risk) is very important therefore.

In principle, the best way to test PSHA models is to compare with observations that are entirely independent of the procedure used to produce the PSHA models. Arguably, the most valuable information in this context should be information on long-term hazard, namely maximum intensities (or magnitudes) occuring over time intervals that are at least as long as a seismic cycle – if that exists. Such information would be very valuable, even if it concerned only a single site, namely that of a particularly sensitive infrastructure. Such a request may seem hopeless – but it is not.

Long-term information can in principle be gained from intact stalagmites in natural caves. These have survived all earthquakes that have occurred, over thousands of years - depending on the age of the stalagmite. Their "survival" requires that the horizontal ground acceleration has never exceeded a certain critical value within that period.

We are focusing here on case studies in Austria, which has moderate seismicity, but a well-documented history of major earthquake-induced damage, e.g., Villach in 1348 and 1690, Vienna in 1590, Leoben in 1794, and Innsbruck in 1551, 1572, and 1589. Seismic intensities have reached levels up to 10. It is clearly important to know which "worst-case" damages to expect.

We have identified sets of particularly sensitive stalagmites in the general vicinity of two major cities in Austria (Vienna and Graz). Non-destructive in-situ measurements have been performed for these and other caves in Austria and Slovakia, in order to determine the horizontal ground accelerations that would result in failure of these stalagmites. These specially-shaped intact stalagmites allow estimating the upper limit on horizontal peak ground acceleration generated by paleoearthquakes. Such information can help make the right strategic decisions.