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In situ measurements of stalagmites' vibration by using portable digital vibrometer - next step of gaining long-term seismic hazard information from intact vulnerable stalagmites

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Earthquakes hit urban centers in Europe infrequently, but occasionally with disastrous effects. Obtaining an unbiased view of seismic hazard is therefore very important.
In principle, the best way to test Probabilistic Seismic Hazard Assessments (PSHA) is to compare them with observations that are entirely independent of the procedure used to produce PSHA models. Arguably, the most valuable information in this context should be information on long-term hazard, namely maximum intensities (or magnitudes) occurring over time intervals that are at least as long as a seismic cycle. The new observations can provide information of maximum intensity (or magnitude) for long time scale as an input data for PSHA studies as well.
Long-term information can be gained from intact and vulnerable stalagmites in natural caves. These formations 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 time period.
To determine this critical value for the horizontal ground acceleration more precisely we need to understand the failure process and the vibration of these intact and vulnerable stalagmites.
The vibration of the stalagmites had been studied several times by different methods before. We had recorded the vibration of the investigated stalagmites by fastening horizontal geophones on them in situ in the karstic caves. Analogue modelling of the vibration by using model sample bodies of a real stalagmite had been carried out in the laboratory too, and numerical computations for modelling the vibration had been done as well.
In the meantime a PDV-100 Laser Doppler Vibrometer of the Polytec Company has been purchased. One advantage of this vibrometer is that the vibration of a stalagmite can be recorded remotely. This is a useful and important feature in real caving circumstances. Another advantage of it that this measurement method can be applied without fastening any mass onto the stalagmite.
The recorded vibration has been analyzed in the laboratory and the eigenfrequency and harmonic oscillations were determined. These values have been compared to the results gained by the previous, geophone-applied method and to the results of numerical computations. We also tried to find answer to the question if there is any change in the differences between the splitting harmonic oscillation values, which were experienced in the previous, geophone-applied method.