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Isotope hydrological studies on the perennial ice deposit of Saarhalle, Mammuthöhle, Dachstein Mts, Austria

General Remarks:

This is an interesting paper which tries to test the suitability of perennial ice deposits in caves with detailed isotope investigations as proxy for the age and origin of cave waters and their paleo-climatological implications. However, basic characteristics of the cave temperature and ventilation, the type and the structure of overlying rocks as well as the potential hydrology during ice formation are not discussed in detail. In addition, the meso- and micro-structure of the ice-core and the potential presence of dispersed minerals in the ice are not documented.

Specific Remarks:

p. 1452 l. 12: *which t*echnique has been used to detect smaller amounts of minerals in the ice or in the ice-water shortly after melting the ice-core.
p. 1452 l. 12: Indicate what depth range you are covering by the 8 samples and how much water was used for the tritium analysis.
p. 1453 l. 3: Write the full name by using the abbreviation HAS for the first time.
p. 1453 l. 4: Report the estimated error of the detection limit of 8.5 TU.
p. 1453 l. 9: Are the reported EC-values corrected to 20° or 25° C?
p. 1453 l. 9: How much of the 12 ml have been used for CO_2- and H_2-equilibration.
p. 1454 l. 9: The most recent description of the ANIP-network can be found at the Umweltbundesamt home-page (http://www.umweltbundesamt.at/en/umweltschutz/wasser/isotopen/) and the available data (up to 2009) of the surrounding stations (Bad Aussee, Feuerkogel, Salzburg and Golling) can be extracted.
p. 1454 l. 16: What is the evidence that the ice deposit melted from the top to the bottom mainly?
p. 1455 l. 8: Using the Viennese and Feuerkogel data (1973-2009) the piston-flow model (no mixing with younger precipitation data) indicate that the present tritium values in the ice-core could be below the critical value of 8.5 TU originating from precipitation 2-28 and >48 years before collecting the samples.
p. 1455 l. 20: The recharge of precipitation can be assumed to be between 1600 – 2500 m above sea-level for this part of the Dachstein massif. The altitude (427m) and the temperature conditions of the Golling station are not comparable to the Dachstein plateau. The Feuerkogel station is at the lower altitude range. In addition, we have to assume changes in the mean delta oxygen values in the range of 1-2 per-mil over the last 100 years as an increase of the oxygen value of about 0.5-1 per-mil has been observed between 1978 and 2004 in many stations.
The linear regression is somewhat ambiguous as -10.9‰ would be in agreement with summer precipitation, but the low deuterium excess is not agreement with elevated values commonly found in mountain stations (see Feuerkogel, Patscherkofel and Villacher Alpe data; KAISER et al.2001; FRÖHLICH et al. 2008). In addition, one has to find good arguments to prevent winter water to infiltrate the caves.
The variation of oxygen-18 data should be plotted versus depth for better interpretation.
p. 1456 l. 11-15: Describe the mechanism of evaporation under almost saturated conditions in more detail and give references to similar situations.
p. 1456 l. 11-15: Well monitored springs of this Dachstein area (Brunnbach, Waldbach-Ursprung, Hirschbrunn, and Koppenbrüller-spring; 1996-2009 and SCHEIDLEDER et al. 2001) in the framework of the Austrian (WGEV)-water quality monitoring (http://www5.umweltbundesamt.at/h2ogispub/webgisKarte.do;jsessionid=E2889546E196C2D0CC4D82E83B69676F.h2o400webgis?wfjs_enabled=true&wfjs_orig_req=/webgisKarte.do?stateId=GW&mobjart=KKMST,PGMST) show a similar seasonal variation in the range of 100 – 250 µS/cm (25°C). Even lower values measured in the ice-core are in the range of

precipitation indicating a minimal contact with soils or carbonate rocks. A direct condensation and freezing from water-vapours cannot be excluded.
The bars with the range of cave "cave dripwater" and meltwater stream in Fig. 4 is misleading. First of all "cave dripwater" can be derived from a "meltwater streams" and secondly the EC-values in various karst areas are influenced by many factors as dissolved CO2, soil thickness, infiltration velocity, limestone/dolomite ratio, additional easily soluble sulfate minerals etc.

KAISER, A.; SCHEIFINGER, H.; KRALIK, M.; PAPESCH, W.; RANK & STICHLER, W.; (2002): Links between meteorological conditions and spatial / temporal variations in long – term isotopic records from the Austrian precipitation network. Intern. Conf. "Study of Environmental Change Using Isotope Techniques", 23-27 Apr. 2001, C&SPaperSeries 13/P, 67-77, IAEA, Vienna.

FRÖHLICH, K.; KRALIK, M.; PAPESCH, W.; RANK, D.; SCHEIFINGER, H. & STICHLER, W. (2008): Deuterium Excess in Precipitation of Alpine Regions – Evaluation of Sub-cloud Evaporation and Moisture Recycling. Isotopes in Environmental and Health Studies, 44, 61 – 70, Taylor & Francis.

SCHEIDLEDER, A.; BOROVICZENY, F.; GRAF, W.; HOFMANN, T.; MANDL, G.; SCHUBERT, G.; STICHLER, W.; TRIMBORN, P. & KRALIK, M. (2001): Pilotprojekt „Karstwasser Dachstein": Bd. 2 Kasrthydrologie und Kontaminationsrisiko von Quellen. Umweltbundesamt Monographie 108 / Archiv f. Lagstättenforschung 21, Geologische Bundesanst., 155 S., Wien.