

To walk in a micromount box...

Frank de Wit

This article is dedicated to Byron Weege

"You know Byron, life just doesn't get much better than this, does it?"

Do you remember, when you were a kid, that you hung a thread in a jar, filled with water and lots of salt? And then after a few days beautiful white crystals had grown on the thread? Then, you imagined that you could shrink yourself, and step into that jar, walk around and look at those beautiful crystals. Meter-large crystals when you were small. You could walk inbetween them, walk on the faces of the crystals, hide behind crystals, touch them. Well.... that's what happened to me in 2005. In real life. Walking inbetween meter-large Halite crystals... That's what this article is about: the Giant Halite crystal cavity in the [Merkers mine](#) in Germany ([ref.1,2,3](#)).



First: a little about salt and “rock-salt” (Halite), the stuff that I’m standing next to in the above picture. What is salt? Well, salt=money... The word “salary” actually comes from the Roman word “salarium”, which again was named after “Sal”. It is believed (but also discussed) that (higher ranked) Roman soldiers were paid with salt. There have been wars for salt-mines. Cities were founded and named after nearby salt-mining (Austria: Salzburg, Hallstatt, Hallein, Hall ; more beautiful, the city of Potaissa (now Turda) in Romania (ref: “Potassium”), etc). Countries became rich and powerful because of salt-mining.

Second: we cannot imagine a life anymore without a refrigerator to keep our food good. But until ca.200 years ago, salt was the only way to preserve food. 8.000 (!) years ago, salt was already used to preserve meat and fish. Salt was important. And it still is... Salt is the basis for many industrial products, for fertilizers and we use it in our food daily as additive. Even better: our body would not function without salt. Salt is one of the primary electrolytes in our body. Too much salt, on the other hand, is again not good for us. And too much rock-salt (Halite) is what you will see when you enter the Merkers-mine!



Land of the white mountains...

The Merkers mine is located in former East-Germany/GDR. In the so-called "Werra-Fulda-region" in the official "Freistaat Thüringen". Also called "the land of the white mountains", referring to the immense white dumps that the salt-mines in this region have left behind. Mining for salt started here ca.2.500 years ago by the Celts. And in the 1860's the first real shafts were created, of which now three large salt-mines are still active (Unterebreizbach/Thüringen and Hattorf-Wintershall/Hessen). Those

mines are now owned by K+S Group. At this moment ca.15.000 (!) people are active in/for these salt-mines, producing ca.35 million tons of salt per year, and producing industrial products from that salt like fertilizers. During the long last winter we have all seen the result of the mining on our streets. Much of the road-salt, to melt the snow, was mined by the K+S Group. For more information see <http://www.k-plus-s.com/>.

At ca.750 meter depth, in 1981, the famous Halite-cavity was originally hit during the active mining operations. Just like coal-mines, also the salt in the Merkers mine is layered and divided in "fields" underground, the so-called "Flöze". Each Flöz is mined via room-and-pillar method and is between 3 and 5 meters high. When the mine was connecting "Flöz Thüringen and "Flöz Hessen" they drove a gallery right into the cavity. What a nice surprise that must have been...

Remember:1981 was during "cold war times". It were difficult times for East-Germany. And the East-German Government was selling mineral specimens from the territory, also from musea, to get 'hard currency' from the West. The mine-management knew that if it became known to the government that they found this extraordinary cavity, the government would remove the big crystals from the cavity, and sell them on the western market. So the miners closed the cavity, and kept it silent to the outside world. Only a few insiders knew about the cavity and were able to visit it, until the 13th of march 1989 at 14:02. At that moment a 5,75 magnitude earthquake, caused



by mining in the Merkers-mine, hit the region and lasted for 12 seconds. The earthquake luckily did not take any lives, but caused damage to 80% of the houses in the region, and... closed the underground entrance to the Halite-cavity. Then, on the 9. of november 1989, the wall fell, and East- and West-Germany were re-united. Times had changed... Time to re-open the Halite-cavity...

The Merkers mine is no longer in production since 1993, and is now a visitors-mine. When we visited the Merkers mine in 2005, they were still securing and stabilizing parts of the mine. So there was still a lot of activity underground. At the present time it's possible for everyone to visit the mine ([ref.4](#)), and to see the cavity via a balcony. But it is not possible to enter the cavity and walk inbetween the crystals. The Merkers-mine itself is ca.140 square kilometers large, and has a stunning 4.000 kilometers of galleries! The Merkers mine is connected



underground to other K+S mines, so the entire mining-region is even larger: ca.1.000 square kilometers! Imagine how long you can drive underground there, without taking the same route twice... If you will be visiting the mine, you'll be descending also by shaft, and then transported by bus 8km to the Halite-cavity.

On 11 march 2005, Dr.Thomas Krassmann, Dr.Thomas Witzke and I had the rare opportunity to visit the mine and enter into the Halite-cavity. Our task was to make 360°-fish-eye-panorama-images of the entire cavity. Arriving at the mine, very early that cold morning, we got our personal guide, mine-clothing, gear and instructions. While there was a snowstorm outside, we descended into the mine and arrived 500 meter lower at a nice temperature of 27°C! There we got into our jeep, and drove 8 kilometers to the Halite-cavity, located ca.200 meter lower at ca. -720 meter.

When we first saw the cavity we fell silent... The doors were closed behind us, and we were of course allowed to walk inbetween the crystals for the photoshoot. We had all the time in the world to do our work and we took our time... The cavity in total is ca.45 meter long. The width is between 7 and 10 meters and to 15 meters high on the highest point. The cavity is slowly shrinking (0,5-1cm/year ; the roof is also slowly sinking) and it's now ca.4.500 m³ large. It's estimated that originally the cavity was 6.000 m³ large. The picture below gives an overview of part of the cavity.



Geology. The Merkers-mine, as well as most of the other mines in the Werra-region, are mining upper-Permian-Zechstein salts. These (to 300 meters thick) layers of salts were deposited as marine evaporates 250 million years ago (Ochsenius' "Barren theory" explains it all). The rock-salt, in which the Halite-cavity is located, consists mostly of Sylvinit (a mixture of Halite and Sylvin). There is almost no rockforming Carnallite present anymore. But in earlier days there was. It is known that in the (pre-basaltic salt-)metamorphoses from Carnallite into Sylvinit, the rockmass shrinks with 50%! It is this shrinking process that made the room for this so called "intrasaline cavity" (for more info on the genesis of the cavity, [see ref.5](#)). Other Halite-cavities were found elsewhere in the mine, but none as big as this one. Later, the cavity filled up with salt-brines. And that's when the growth of the crystals started...



But... after that metamorphoses-process, another, perhaps even more interesting geological phenomenon started. The basalt-intrusions! 15 Million years ago, Basalt-intrusions vertically entered the more or less horizontal Evaporite salt layers. The hydrothermal fluids, coming up with the Basalt, reacted with the minerals in the salts, and created interesting new minerals on the contact zones and in cavities in the Basalt. The nice thing about these Basalt-intrusions, is that they are very well visible underground as vertical black and reddish veins cutting through the horizontal salt.

And sometimes even spreading horizontal into the salt layers. More on that in the following mineralogy-chapter...

The mineralogy of a salt-mine might sound very boring to you. It sounds like just salt, salt, and more salt. And in fact: yes, the genesis of the Halite-salt crystals in that cavity is quite simple. As I started this article: salt-brines, waters almost saturated in salts, filled up the cavity, and crystals slowly started to grow. There were Halite-"seeds" in the rock. The conditions in the cavity remained stable for a longer time. Then the temperature slowly dropped and because of that, the over-saturation of the brine-fluid started. The large Halite crystals then simply grew around the seeds. In a delicate equilibrium, over a longer time, of dropping temperature, with a changing saturation and with an (in)stable surrounding rock. When the water evaporated again from the cavity, the crystals were just hanging there, waiting to be discovered.



If the mine had not frequently drilled into the cavity already by accident (releasing the ca.6 million liter brine in the cavity) the crystals would still have been growing. Growing into multiple meter large Halite crystals. Perhaps even filling up the cavity completely (at continuous minimal over-saturation of the solution). But then the crystals hanging on the roof would have become too heavy, and would probably have dropped off. Crashing the crystals again growing on the floor... It is estimated, that the Halite-cavity



was enclosed in the salt layers for between 15 and 20 million years. Of which the last hundred years there was active mining below the cavity, with all the blasting and drilling. And... 200 meters from the cavity there is a Basalt-intrusion! Had the Basalt intruded the cavity, 15 million years ago, it would never had become a closed system, and we would not have walked inbetween hundreds of Halite crystals a few years later. So it's a little geological miracle that the hundreds of Halite crystals survived... And the timing of the miners was perfect. Over all those millions of years they opened the cavity just in time.

The largest Halite crystals in this immense cavity are 1,10 meter big. Ergo: 1 cubic meter in size. Sometimes, of course, these meter-large crystals grow together and form even larger aggregates. But the most stunning crystals are the waterclear, ca.20-40cm large, individual Halite-crystals hanging from the ceiling. Dozens of them. Only waterclear to white Halite crystals are found here, and frequently have fluid inclusions of salt-brines. Similar sized and quality Halite-crystals were found, as you know, in your worldfamous Wieliczka mines. But also in the PCA-mine near Carlsbad in 1962. For more “giant crystal cavities” see [ref.3](#).





Nevertheless, the size of this Halite-cavity is unprecedented. The floor of the Halite-cavity consists of a layer of max.20cm thick lightgray to grey mud containing Gypsum, Anhydrite, Polyhalite, Talc, Illite, Chlorite and Quartz. And the walls of the cavity consist of mostly Sylvinite and little Carnallite here.

As I wrote earlier: for me the most interesting mineralisation in salt mines, is where Basalt intrudes the salt. So also here in the Merkers mine. A handful of rare minerals is found directly around these Basalt-

intrusions. When we visited the mine in 2005, we were allowed to drive a few more kilometers underground to one of these Basalt-intrusions. It is not uncommon to find rare minerals like Kainite, Polyhalite, Leonite, Langbeinite, blue Halite, sulfides, zeolites and even some yet unknown phases in those Basalts and on the contacts. When the jeep stopped it was impossible to miss the basalt-intrusion at the side of the road. We were allowed to sample on that contact and found Rinneite (together with Sylvite, Halite, Anhydrite and Akaganeite, [ref.8](#)), which was a superb bonus for this underground trip. I then walked a little away from the contact zone, where I saw another large cavity, of which the floor was filled with brine. I crawled into that cavity, over layers of broken Bischofite crystals. And when I looked up, the ceilings were full of Carnallite-crystals to 2,5 cm long! Knowing that Carnallite is hygroscopic, I took three pieces with me in plastic. We stepped into the jeep again, drove ca.10 kilometers underground, and 500 meters up again we went. Into the snow storm... The end of a warm and unforgettable day!



For more pictures of this Halite cavity, please see <http://www.facebook.com/frankdewit>. If you're interested in a full-color article including some more color photos, please contact us via our travel website www.mineraltravel.com.

Have fun!

References:

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Table 1: Minerals from the Merkers mine.

III - Halides	VII - Sulphates, Chromates, Molybdates and Tungstates
Bischofite $MgCl_2 \cdot 6H_2O$	Aphthitalite $(K,Na)_3Na(SO_4)_2$
Carnallite $KMgCl_3 \cdot 6H_2O$	Blödite $Na_2Mg(SO_4)_2 \cdot 4H_2O$
Halite $NaCl$	Kainite $KMg[Cl SO_4] \cdot 3H_2O$
Rinneite $K_3Na[FeCl_6]$	Kieserite $MgSO_4 \cdot H_2O$
Sylvite KCl	Langbeinite $K_2Mg_2(SO_4)_3$
IV - Oxides and Hydroxides	Leonite $K_2Mg(SO_4)_2 \cdot 4H_2O$
Akaganeite $\beta-Fe^{3+}O(OH,Cl)$	Löweite $Na_{12}Mg_7(SO_4)_{13}$
VI - Borates	Polyhalite $K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$
Boracite $Mg_3[Cl B_7O_{13}]$	
Lüneburgite $Mg_3B_2(PO_4)_2(OH)_6 \cdot 6H_2O$	

Pictures

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(Byron Weege, Rogerley mine, July 2009, enjoying his pipe after nice wet and muddy mineral collecting underground. Byron passed away 28.July 2010...)

