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Title of article Problems in determination of the water content of rock-salt samples and its significance in nuclear-waste storage siting

Author(s) Edwin Roedder et al.

see Geology v. 9, p. 525 - 530

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Table 2 and References

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Table 2. Literature data on water content of samples from proposed nuclear waste storage sites in rock salt deposits.

REFERENCE	SALT SOURCE	SAMPLE Wt.	Form	EXTRACTION METHOD	ANAL. METHOD	Wt. % H <sub>2</sub> O	ANALYSIS NOTES	SAMPLE PREPARATION AND OTHER NOTES
Kaufmann, 1960	Carey salt mine Hutchinson, Kansas	10-20 g	<40 mesh	Heating 1 h, 105°C.	Weight loss	0.089	Average of 3	1-2.5 kg ground to <40 mesh, mixed, and quartered.
Same	Detroit mine, Inter- national Salt Co., Michigan	"	"	"	"	0.165	Average of 4	
Same	Avery Island mine, International Salt Co., Louisiana	"	"	"	"	0.022	Average of 7	
Bradshaw and McClain, 1971, p. 5-6 and 171	Hutchinson, Kansas	1-2 lb	"Chunks" (p. 170)	Heating to 400°C	Absorb and weigh	0.188	Average of 4, from 0.127-0.293%	Heating time unspecified.
Same	Lyons, Kansas	"	"	"	"	0.080	Average of 4, from 0.048-0.100%	Clear crystal, atypical.
Same	Hutchinson, Kansas	153g	"	"	"	1.08		
Same; p. 170	Lyons, Kansas	?	?	Heating to 625°C	"	0.50 1/	Average of samples > 2 ft from wall of array hole, both before and after test	From context, samples presumed to be in the form of chunks or sections of whole core. Heating time unspecified.
Bradshaw and McClain, 1971, p. 170	Retsof salt mine International Salt Co.	?	?	"	"	"	Volume percent "water" 0.06	
Same	Detroit salt mine International Salt Co., Michigan	?	?	"	"	"	Volume percent "water" 0.90	
Kopp and Fallis, 1973	Lyons, Kansas Cores 1 & 2	1.5- 2g	60- 120 mesh	Heating to 102+5°C 2-4 1/2 days	Weight loss	0.0- 19.0	Also in Powers, et al., 1978, p. 7- 38, but referred to there as "Hutchinson" salt cores 1 and 2. The 19% value was from a sample of gypsum.	Approximately 3/4 lb was crushed <1/4" and quartered; only 60- 120 mesh fraction used.
Kopp and Combs, 1975	WIPP site, New Mexico Cores 7 & 8	1.5- 2g	60- 120 mesh	Heating to 102+5°C 2-4 1/2 days	Weight loss	0.1- 3.5	Also in Powers, et al., 1978, p. 7-37 and Appendix 7.G.	

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Beane and Popp, 1975	WIPP site, New Mexico Cores 7 & 8	1-2g	90% <100 mesh	Heating, 70°C, 2 h.	"	"	0.02-1.87	Also in Powers et al., 1978, p. 7-7 and Appendix 7.A; samples range from essentially pure salt to 69% in-soluble. Only wt. loss <300° attributed largely to H <sub>2</sub> O.	Ambiguous: "Each sample was dried at least 3 days at 65°C" (p. 7-7). "Nuggets" crushed and ground <10 mins before weighing, but in laboratory air that was "relatively high" in humidity (p. 7-14).
Same	Same	0.1g	"powder"	TGA at 10°C/min	"	"	0.10-6.84		
Hohlfelder and Hadley, 1979; Hohlfelder, 1979b	Miss. Chem. Co. mine, near WIPP site, New Mexico	~ 1kg	Cylinder (core)	Heating to 250°C over 3 days in inert gas stream	Weight loss, and absorb and weigh		0.10-0.15	Wt. % values given are based on an assumed sample weight of 1 kg.	Thoroughly air-dried (up to one year).
Hohlfelder, 1979b	Miss. Chem. Co. mine, near WIPP site, New Mexico	20g	1-2g pieces	Heating 1-5 days at each of 13 temps.: 75-325°C	Weight loss		0.09		
Jockwer, 1979, and personal communication	Asse salt mine, Germany	3g	< ~ 1mm	TGA (separate samples to each temperature)	Weight loss		~ 0.15	Liquid water evaporation contributes ~ 0.02%; then ground to <1 mm in sealed ball mill with iron balls and mineral dehydration bottled.	1-5 kg core "crushed quickly" to ~2 cm in air at ~30% humidity, balance from ball mill with iron balls and bottled.
Jockwer, 1980, and personal communication	Asse salt mine, Germany	1-50g	< ~ 1mm	Heat to 400°C in flowing N <sub>2</sub> and dissolve H <sub>2</sub> O in 100 ml methanol	Karl Fischer titration		~ 0.15		
Jockwer, 1980, and personal communication	Asse salt mine, Germany	~ 1kg	< ~ 1mm	Heat to 400°C in flowing N <sub>2</sub>	Condense at -78°C and weigh		~ 0.15	Got some HCl also.	
Hite, et al., 1979	Non-diapiric salt anticline, Northern Paradox Basin, Utah	1kg	Core	Solution in hot methanol	Karl Fischer titration		0.21		
Hite and Ging, 1981 <sup>2/</sup>	Diapiric salt anticline in Salt Valley, Utah	1000-1800g	"	"	"		0.008-0.117	Range for 22	Preliminary determination; appears to be anomalously high, based on subsequent work (R.J. Hite, personal communication, 1981). Very pure (<2% insoluble, mainly anhydrite). Personal comm., R.J. Hite and T.G. Ging, 1981.

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Bassett and Roedder; 1981		Palo Duro basin, TX	1-2g	40-60 mesh	Solution in methanol	Karl Fischer titration	0.15- 2.25	Range for 7	Analyses by Oak Ridge National Laboratory, samples had 0.51 to 32.66% insolubles.
Same	Same	Same	"	"	Heat at 150° 1 hr in air	Weight loss	0.08- 2.30	Range for 8	
Same	Same	Same	"	"	Heat at 650° 1 hr in air	"	0.17- 6.29	Range for 8	
Same	Same	Same	~ 1200g	Core	Whole core refluxed with hot methanol	Karl Fischer titration	0.27- 1.82	Range for 6	
Gustavson, et al., 1980		Palo Duro and Dalhart basins, TX	1-2g	40-60 mesh	Solution in methanol	Karl Fischer titration	0.15- 2.44	Range for 7	Analyses by R.J. Hite, USGS.  Free water only; does not include water from clay minerals and oxy- hydroxide phases. Note particularly: the values given are normalized to an insoluble-free basis.
Knauth and Kumar, 1981		Weeks Island dome, Louisiana	3-56g	Pieces	Heating to 1000°C in vacuo	Reduce H <sub>2</sub> O to H <sub>2</sub> and measure manomet- rically	0.01 - 0.09	Range for 10	
Same	Belle Island dome, Louisiana	"	"	"	"	"	0.003- 0.52	Range for 6	
Same	Jefferson Island dome, Louisiana	"	"	"	"	"	0.001- 0.004	Range for 4	
Same	Avery Island dome, Louisiana	"	"	"	"	"	0.003- 0.004	Range for 3	Mine samples. These data super- cede preliminary data by L.P. Knauth, published in Martinez, et al., 1980 (personal communica- tion, L.P. Knauth, 1981).
Same	Vacherie dome, Louisiana	"	"	"	"	"	0.001- 0.004	Range for 5	
Same	Rayburn's dome, Louisiana	"	"	"	"	"	0.0005- 0.006	Range for 5	

1/Presumed, from context, to be weight % but may be volume %.

2/Personal communication - see notes.

## References (to Table 2)

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