

TABLE 4. MASS SPECTROGRAPHIC ANALYSES OF REACTION GASES^{a,b,c} AND WET-CHEMICAL ANALYSES OF RESIDUAL CO₂ IN UNREACTED D^oLOMITE: DOLOMITE-HYDROGEN SYSTEM

Experiment No.	39	41	42	43	44	45	46	47	49	50	51	56	57	58	59	83	84
Temperature (°C)	520	525	550	620	735	620	620	620	735	735	735	735	735	735	835	605	605
Pressure (psi)	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	4,000	4,000	5,000	2,000	2,000
Wt. % CO ₂ remaining in solid	N.A. ^d	44.3	40.2	25.6	10.1	25.4	30.7	19.4	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.87	N.A.	N.A.
Duration of run (hours)	4	4	4	4	4	8	2	12	4	4	4	4	6	7	4	2	4
Mole % CH ₄ in gas	0.01	0.02	0.04	1.20	2.34	1.82	1.53	2.05	2.00	1.88	1.77	1.80	2.86	4.76	2.12	0.46	2.64
Mole % C ₂ H ₆ in gas	—	—	0.01	0.02	—	0.04	0.05	0.04	—	—	—	—	—	0.03	—	0.03	0.14
Mole % CO ₂ in gas	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.09	0.03
Mole % CO in gas	—	—	0.04	—	—	—	—	—	—	—	—	—	—	—	—	0.72	0.13
Mole % H ₂ in gas	97.70	99.90	99.30	98.70	97.60	98.00	98.40	97.80	98.00	98.10	98.10	98.16	97.10	95.20	97.86	98.6	97.0
Mole % He in gas	2.25	0.10	0.12	0.07	0.04	0.10	0.03	0.07	0.03	0.05	0.11	0.03	—	0.06	0.01	0.06	0.08

^a Analysis calculated on water-free basis.

^b Starting hydrogen impurities given as follows: less than 5 ppm N₂, less than 1 ppm O₂, less than 1/2 ppm CO₂, less than 1/2 ppm CO, Dew point—100°F.

^c Detection limit 0.01%.

^d Not analyzed.

TABLE 5. MASS SPECTROGRAPHIC ANALYSES OF REACTION GASES^{a,b,c} AND WET CHEMICAL ANALYSES OF RESIDUAL CO₂ IN UNREACTED SIDERITE SIDERITE-HYDROGEN SYSTEM

Experiment No.	86	87	89	40
Temperature (°C)	605	455	400	525
Pressure (psi)	2,000	2,000	2,000	5,000
Duration of run (hours)	4	4	4	4
Mole % CH ₄ in gas	0.15	4.34	4.45	1.45
Mole % C ₂ H ₆ in gas	—	0.42	0.28	0.12
Mole % C ₃ H ₈ in gas	—	0.23	0.10	0.03
Mole % C ₄ H ₁₀ in gas	—	0.05	0.03	—
Mole % CO ₂ in gas	—	—	—	0.04
Mole % H ₂ in gas	99.80	94.90	95.10	95.30
Mole % He in gas	0.04	0.08	0.09	3.07

^a Analysis calculated on water-free basis.

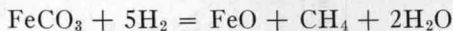
^b Starting hydrogen impurities given as follows: less than 5 ppm N₂, less than 1 ppm O₂, less than ½ ppm CO₂, less than ½ ppm CO, Dew point—100°F.

^c Detection limit 0.01%.

each case to bring the bomb up to temperature before venting and replacing hydrogen for the reaction gas. Because of the low temperature for thermal dissociation of siderite, in those experiments at higher temperatures some siderite undoubtedly decomposed and the decomposition gas, presumably CO₂, was expelled along with the helium. For this reason the mole percent of gaseous hydrocarbons determined in the reaction gas for these experiments are minimum values (Table 5).

The solid reaction products for experiments 40 (525°C, 5000 psi), 86 (605°C, 2000 psi), and 87 (455°C, 2000 psi) are iron (Fe) and wüstite (FeO). The solid reaction produced from experiment 89 (400°C, 2000 psi) is magnetite. In all of the experiments the reaction gases were sampled and replaced with helium at the reaction temperature. Minute and rare flecks of what optically appeared to be graphite were observed, but no certain identification was made.

The limited data available suggests that wüstite is the primary alteration solid. The ultimate H₂O/H₂ ratio and the temperature dictate whether wüstite will be reduced to native iron or oxidized to magnetite. The simplified stoichiometric relations would be the following:



if reducing:

