has been investigated mainly in the context of the most well-studied of these meteorites, Murchison, a CM group chondrite. Previous theoretical work [1] has demonstrated the link between the alteration of the mineral assemblages and production of organic compounds. The CI group, however, has experienced more extensive alteration than the CM group [2–4] and also contains abundant soluble organic material [5–6]. The purpose of this study is to explore the relationship between the extent of alteration of the CI group and the potential for synthesis of soluble organic material during the alteration. Model calculations for the CI group are compared to those for the CM group.

Modeling Parent-Body Processes: Despite the extensive nature of alteration products present, the CI chondrites are considered to be the most primitive meteorites because their bulk chemistry is identical to that of the solar photosphere [7–8]. For this reason, I adopted the average bulk composition of the CI chondrites from Dodd [9] for modeling the aqueous alteration processes using mass-transfer, reaction-path calculations. The nature of the fluid responsible for the alteration remains speculative, but I have chosen a relatively oxidizing, dilute solution saturated with CO_2, CO, CH_4, N_2, and NH_3 as the starting fluid. I minimized the Gibbs free energy of closed chemical systems using stable and metastable equilibrium constraints at various temperatures that may have been reached during the alteration process.

Results: The calculations result in mineral assemblages that are consistent with observations of CI chondrites. For example, at 100°C, the approach to equilibrium produces serpentines (antigorite, cronstedtite, greenalite), dolomite, carbonates, sulfides, chlorite, and other phyllosilicates. This mineralogy is similar to that previously calculated for CM chondrites [1], except for the appearance of dolomite for the CI, which is in agreement with the presence of this mineral in CI and its absence in CM chondrites. The final alteration event in CI chondrites may have involved a more severe loss of volatiles at higher temperatures than experienced by the CM group. This is supported by the presence of sulfate veins that crosscut previously formed alteration.

Another similarity to the CM models is the predicted appearance of soluble organic and the nature of these compounds. Carboxylic acids dominate the organic C speciation in the calculations, followed by amides, metal-organic compounds, ketones, alcohols, and other organic compound families.

The results of these calculations suggest that the nature of the alteration of the CI and CM chondrites was probably very similar, and that the presence of soluble organic compounds in each of these meteorite classes is due at least in part to formation from inorganic precursors during the aqueous alteration event(s) responsible for the observed mineral assemblages.

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TEN NEW METEORITES FROM THE TÉNÉRÉ DESERT (NIGER): CLASSIFICATION, NOBLE GASES, COSMOGENIC RADIONUCLIDES, AND TERRESTRIAL AGES. L. Schultz[1], P. Scherer[1], B. Spettel[1], F. Wlotzka[1], J. Zipfel[1], J. Schlüter[2], S. Merchel[1,3], U. Herpers[3], J. Newton[4], I. A. Franchi[4], C. T. Pillinger[4], I. Leya[5], S. Neumann[5], U. Neupert[5], R. Michel[5], P. W. Kubik[6], H.-A. Synal[6], G. Bonani[7], I. Hajdas[7], S. Ivy-Ochs[7], and M. Suter[7], [1]Max-Planck-Institut für Chemie, 55020 Mainz, Germany (schultz@mpch-mainz.mpg.de), [2]Universität Hamburg, 20146 Hamburg, Germany, [3]Abteilung Nuklearchemie, Universität zu Köln, 50674 Köln, Germany, [4]Planetary Science Research Institute, The Open University, Milton Keynes, UK, [5]Zentrum für Strahlenschutz und Radioökologie, Universität Hannover, 30167 Hannover, Germany, [6]Paul Scherrer Institut c/o Institut für Teilchenphysik, Eidgenössische Technische Hochschule Hönggerberg, 8093 Zürich, Switzerland, [7]Institut für Teilchenphysik, Eidgenössische Technische Hochschule Hönggerberg, 8093 Zürich, Switzerland.

In March 1997, 10 new meteorites were found in the Ténéré, a part of the Sahara located in Niger. The total recovered weight was about 37 kg, with the largest specimen weighing 27 kg. Table 1 gives the classification of these meteorites as obtained from mineralogical-petrographic investigation and the O-isotopic composition. Grein 002 is, according to its Si content in the metal, an EL chondrite; however, several bulk element concentrations do not allow a clear distinction between EL and EH.

We have measured concentrations and isotopic compositions of all noble gases. Furthermore, we have determined concentrations of long-lived cosmogenic nuclides ^{10}Be, ^{26}Al, and ^{36}Cl in bulk samples and magnetic fractions using accelerator mass spectrometry (AMS) after radiochemical separation. From the known ^{21}Ne radiation ages and ^{14}C terrestrial ages, we corrected the measured radionuclide activities to production rates at time-of-fall, which allows us to compare our results directly with theoretical production rates [1].

To obtain terrestrial ages, ^{14}C in these chondrites was also measured. Terrestrial ages were calculated from these values and depth-dependent production rates taken from the physical model [1].

The O-isotopic composition is strongly influenced by O from terrestrial weathering products. However, this effect is highly variable, as recorded by the H5 chondrites, suggesting either gross local variation in weathering conditions or different terrestrial ages.

The four H5 chondrites Tiffa 001, 004, 005, and 006 were found within a distance of about 10 km. They appear petrographically very similar, and their exposure ages agree within the limits of uncertainty (7.0 ± 0.5 Ma). The shielding conditions — represented by the cosmogenic $^{22}Ne/^{21}Ne$ ratio — are, however, very different. According to the radionuclide concentrations, Tiffa 001 is probably not paired with the other three H5 specimens.

Carbon-14 measurements indicate that many of these meteorites have terrestrial ages of 3400 to 5700 yr. This is in agreement with the surface conditions of the find location. Neolithic artifacts found in the vicinity of the meteorites indicate that this part of the Sahara became arid (i.e., ideal for prolonged preservation) only a few thousand years ago. Only Adrar Madet, found under other surface conditions, has a terrestrial age of ~8000 yr, while Grein 002 and Tiffa 003 are recent falls.

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TABLE 1. Classification, shock and weathering grades of the investigated meteorites.

Name	Type	Shock	Weath.
Grein 001	H3	S2	W1
Grein 002	E4–5		W0
Grein 003	H6	S1	W1
Tiffa 001	H5	S2	W2
Tiffa 002	H4–5	S1	W3
Tiffa 003	L6	S3	W1
Tiffa 004	H5	S2	W2
Tiffa 005	H5	S2	W2
Tiffa 006	H5	S2	W2
Adrar Madet	H5–6	S2	W3

(Names need to be approved by the Nomenclature Committee of the Meteoritical Society.)