AQUEOUS ALTERATION IN THE NWA817 MARTIAN METEORITE. Ph. Gillet[1], J.A. Barrat[2], G. Crozaz[3], E. Deloule[4], A. Jambon[5], D. Neuville[6], V. Sautter[7], M. Wadhwa[8], [1]Laboratoire des Sciences de la Terre, ENS Lyon, 69346 Lyon, France (pgillet@ens-lyon.fr), [2]Laboratoire de Géodynamique et Planétologie, Université de Nantes, France. [3]Laboratory for Space Sciences, Washington University, St Louis, USA, [4]CRPG, CNRS, Nancy, France, [5]Laboratoire MAGIE, Université de Paris VI, Paris, France, [6]Département des Géomatériaux, IPG Paris, France, [7]Museum National d'Histoire Naturelle, Paris, France, [8]Department of Geology, The Field Museum, Chicago, USA.

Introduction: The identification and characterisation of water reservoirs on Mars can be done indirectly through petrographic and geochemical studies of pre-terrestrial alteration products in the SNC meteorites. Several such studies have been performed so far on the three known meteorites nakhlite subclass (Nakhla, Lafayette and Governador Valadares)[1,2,3]. The predominant alteration products of these meteorites are : a material loosely termed iddingsite that fills fractures crosscutting magmatic minerals and mesostasis, carbonates and evaporitic minerals including halite, gypsum and anhydrite [3]. Hydrogen isotope studies indicate that these martian crustal rocks have been altered by an aqueous fluid that has exchanged with the martian atmosphere A fourth nakhlite, NWA817, has been recently discovered in the Saharian desert. The present work provides the description and interpretation of the alteration products observed in this stone.

Results: NWA 817 is an olivine-bearing clinopyroxenite with a cumulate texture. The intercumulus mesosatasis is made of feldspars including minute amounts of sulfide droplets, Ti-magnetite and acicular pyroxene. Pervasive reddish alteration products similar in appearance to that described in other nakhlites crosscutting olivines, pyroxenes and the mesostasis are observed. Pre-terrestrial carbonates or other evaporitic minerals have not been identified so far. Terrestrial weathering is marginal as indicated by the absence of weathering of the sulfides present in the rock. Electron microprobe data show that the chemical composition of the reddish phase is different from that of the iddingsite in the other nakhlites. The mean composition of this phase (below) shows that it has significantly lower Al and higher Fe content than the iddingsite in the other nakhlites:

SiO_2	Al_2O_3	FeO	MgO	CaO	Na_2O	K_2O	sum
43.9	0.1	37.2	5.8	0.1	0.2	0.5	87.8

Water content of ~12 wt% is inferred in this phase. SEM and optical observations suggest a well-crystallized material and not a mixture of various crystalline and/or amorphous phases. The Raman spectrum of the phase is close to that of cronstedtite a serpentine-related mineral.

The concentrations of trace elements as measured by ion microprobe reveal a V-shaped REE pattern with a positive Eu anomaly in the reddish phase. The overall REE pattern compared to those of the magmatic minerals indicate the precipitation from a fluid which has previously altered feldspar, olivine and apatite. Preliminary hydrogen isotope measurements have been carried out on both magmatic minerals and the reddish phase by ion microprobe. The measured δD values for magmatic minerals range from – 50 to – 300 per mil, and in the reddish alteration phase range from -150 to -250 per mil. These values are significantly lower than those measured in volatiles released in the high temperature steps from bulk samples of the other three nakhlites [4]. Negative δD values are usually explained in terms of contamination by terrestrial adsorbed water component. However, contribution from adsorbed water, monitored by using the value of H_2^+/H^+ as described by [5], was minimal in our analyses. Therefore, we suggest that the alteration products observed in the NWA817 nakhlite, the apparent absence of carbonates and the negative δD values can be explained by the percolation through the rock of a fluid originating from the martian mantle.

References: [1] Gooding J.L. et al. (1991), *Meteoritics, 26,* 135-143. [2] Treiman et al. (1993), *Meteoritics, 28,* 86–97. [3] Bridges J.C. and Grady M.M. (2000), *Earth & Planet. Sci Lett., 176*, 267-279. [4] Leshin et al. (1996), *Geochim. Cosmochim. Acta, 60,* 2635-2650. [5] Deloule et al. (1991) *Geochem. Soc. Special Publ. No. 3,* p.53.