SYNTHESIS OF CLAY MINERALS AND THE RELATIONSHIP WITH FORMATION PROCESSES AND CRYSTAL CHEMISTRY. P. Andrieux[1] , S. Petit[1], and A. Decarreau[1], [1]HydrASA, Université de Poitiers, 40 avenue du Recteur Pineau, 86022 Poitiers Cedex, pauline.andrieux@etu.univ-poitiers.fr, sabine.petit@univ-poitiers.fr

Different approaches have been used for the determination of the mineralogy at the Mars surface.

The direct measurements with spacecraft, the study of Martian meteorites, and the laboratory measurements on analogue materials have permitted to determine the Martian soil composition. Thanks to theses different approaches, clays and clay minerals have been discovered on Mars surface [1].

Several smectites have been identified. The main phyllosilicates on Mars are the iron-rich clays as nontronite. But Mg- and Al-rich members are also present and have been detected on Mars' surface for example as Saponite and Montmorillonite. Clay minerals on Mars can compare to Earth's analogues which could permit to understand the condition of formation and crystal chemistry [2].

Three processes are important in the origin of clay minerals. Under the condition of the earth's surface, the alteration of other silicate minerals could lead to the formation of clay minerals. At pressures or temperatures higher than those of the earth's surface, clay minerals are the result of recrystallisation processes. And, precipitation from solution is the third process. For theses different processes, aqueous solution plays a major role in the formation of clays in natural and synthetic system [3].

Clay minerals synthesis is useful to the understanding of formation processes in nature on Earth and Mars. Synthesis at low temperatures can permit to understand the formation processes in surface.

The clay minerals which were already evidenced on Mars could be possibly synthesized in laboratory.

The conditions of formation of clay minerals in synthetic systems depend on pH, temperature, pressure, starting materials and element concentrations.

For example, regarding nontronites, their synthesis have been realized in the past by Caillère and al. (1953, 1955) mixing dilute solution of silica, iron (II) or (III) chlorides, and salts of Mg and Al at low temperature (100°C) and adjusting pH between 8,5 and 9,5. They obtained very diluted suspensions of nontronites. Hamilton and Furtwängler (1951) obtained also very diluted suspensions of nontronite using sodium metasilicate and iron (III) chloride at high temperature. Decarreau and Bonnin (1986) or Decarreau and al. (1987) synthesized ferric smectite under partially reducing or oxidizing conditions using coprecipitated gels of silica and $FeSO_4$ at low temperature below 150°C. But they obtained "defect nontronite". Several authors described the synthesis of nontronites but obtained poorly crystalline nontonites or in very diluted solutions [4, 5, 6, 7, 8].

Recently, we obtained synthetic nontronites using coprecipitated gels containing Si, Al and Fe. Iron-rich nontronites with different rates of aluminium are obtained.

Using Clay minerals synthesis, we can better determine the condition of formation of equivalent natural clays knowing their physical and chemical conditions of synthesis.

Furthermore, synthetic clays can be used as reference samples for spectroscopic interpretations. Analogue Martian clay minerals synthesized in laboratory could lead very important research on the formation of this clays and their crystallochemistry.

References:

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