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ABSTRACT

In the first part of this paper, the adsorption of amino acids (alanine, Ala; metionine, Met; glutamine, Gln; cysteine, Cys; aspartic acid, Asp; lysine, Lys; histidine, His) on clays (bentonite, kaolinite) was studied at different pH (3.00, 6.00, 8.00). The amino acids were dissolved in seawater, which contains the major elements. The main achievement of this paper was that Cys could play an important role in prebiotic chemistry besides just being one of the amino acids in the peptides/proteins. The amino acids with a charged R group (Asp, Lys, His) and Cys (uncharged R group) were adsorbed on clays more than Ala, Met and Gln (uncharged R groups). However, 74% of the amino acids in the proteins of modern organisms have uncharged R groups. These results raise some questions about the role of minerals in providing a concentration mechanism for amino acids. Several mechanisms are also discussed that could produce peptides with a greater proportion of amino acids with uncharged R groups. The infrared spectra (FT-IR) showed that the adsorption of amino acids on the clays occurs through the amine group, probably as NH_3^+ . However, the Cys/clay interaction occurs through the sulfhydryl and amine groups. X-ray diffractometry showed that pH affects the bentonite interlayer, and at pH 3.00 the expansion of Cys/bentonite was greater than that of the samples of ethylene glycol/bentonite saturated with Mg. The Mössbauer spectrum for the sample with adsorbed Cys showed a large increase (~ 20%) in ferrous ions. This means that Cys was able to partially reduce iron present in bentonite. This result is similar to that which occurs with aconitase where the ferric ions are reduced to Fe 2.5. In the second part of this paper the adsorption of several DNA/RNA bases (adenine, A; cytosine, C; thimine, T; uracil, U) dissolved in seawater on clays (bentonite, kaolinite, montmorillonite) was studied at two pHs (2.00, 7.20). Kaolinite adsorbed a small amount of A at pH 2.00 and the other bases were not adsorbed on this mineral. The results showed that the bases A and C were much more adsorbed on bentonite and montmorillonite than the bases U and T. These results raise two questions a) the pH where the adsorption was bigger is very lower, beside it occurs in hydrothermal, but were these environments commons? b) the other problem is worst, the amount of base in the living beings do not have the same rate that were found in

these experiments. The analyses of DNA bases of several organisms showed that rate of A/T are about 1.00. However the results showed that A is always more adsorbed than T, so the rate A/T is much bigger than one. These results raised some questions about the role of minerals in providing a concentration mechanism for DNA/RNA bases: should we expect the composition of adsorbed DNA/RNA bases on minerals to reflect that of present day DNA/RNA? Was the adsorption of nucleic acid bases on minerals important in the origin of life? The results of infrared spectroscopy showed that the bases interact to clays through amine group.