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CONTRIBUTION OF EXPERIMENTAL STUDIES TO THE KNOWLEDGE OF SHORT-RANGE ORDERED MINERALS IN SOILS

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As a starting point, it is stressed that the soil constituents, formerly called amorphous, have noneless a short range order organization and hence diagnostic structural properties provided that the appropriate tools are used. As this information was not available when the first attempts of synthetizing soil-like poorly organized minerals were initiated, the contribution to soil mineralogy of these studies have to be reappreciated in the light of our present knowledge.

In some instance, examplified in the present paper by the minerals belonging to the Fe_2O_3-SiO_2-H_2O system (pure and siliceous ferrihydrites), a part of the relevant experimental approaches preceded the description of natural samples and contributed much to their correct identification (Table I and II).

Fo the minerals belonging to the Al_2O_3-SiO_2-H_2O system (allophanes and imogolites) the validity of most of the information available from experimental studies before 1972 (i.e. before the elucidation of the structural scheme of imogolite) appears to be questionable (Table III). Since then, we are experiencing the synergetic effect due to the relay between the information originating the examination of natural samples and their synthetic counterparts. In the laboratory, imogolite and allophane are produced under a range of specific pH conditions which help to explain their simultaneous occurrence in several locations. The discovery that the crystallization of imogolite is a via solution process throws also a new light on the fate of aluminium during soil genesis.

Table I : Nomenclature and chemical composition of the short range ordered minerals belonging to the Fe_2O_3-SiO_2-H_2O system (modified from Wada, 1982).

Rapports atomiques		Minéraux
$\frac{Si}{Fe}$	$\frac{Fe}{Fe + Si}$	
∞	0	Opales
~ 1	~ 0.5	Hisingérites
~ 0.5	~ 0.66	Ferrihisingérites ou ferrihydrites très siliceuses
0.4 à 0.01	0.70 à 0.99	Ferrihydrites siliceuses
0	1	Ferrihydrites non siliceuses

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Table III : Nomenclature and chemical composition of the short range ordered minerals belonging to the Al_3O_2-SiO_2-H_2O system (modified from Wada, 1982).

Rapports atomiques		Minéraux
$\frac{Si}{Al}$	$\frac{Al}{Al + Si}$	
∞	0	Opales
10.0 à 9.0	0.01 à 0.10	Opales alumineuses
1.2 à 0.4	0.45 à 0.70	Allophanes
0.5	0.666	Imogolites
0.25	0.80	Allophane-like (1)

(1) Ce nom est conservé de Wada (1982). Les « allophane-like » pourraient être des constituants organominéraux plutôt que des minéraux s.s.