

SOIL IRON FORMS : COMPARISON BETWEEN CHEMICAL METHODS AND MOSSBAUER SPECTROMETRY

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Chemical methods using various extractants are commonly employed to differentiate and determine iron forms in soils. From six soil samples containing more or less organic matter, the chemical determination of iron forms was compared to the diagnostic provided by Mössbauer spectrometry.

The chemical determination was obtained from total iron and Fe extractable by three extractants : citrate-bicarbonate-dithionite (MEHRA and JACKSON, 1960), oxalate buffered at pH 3 (SCHWERTMANN, 1964 ; McKEAGUE and DAY, 1966) and EDTA at pH 10 (BORGGAARD, 1976 ; JEANROY, 1983). Each of the extractants was carried out on separate soil aliquots. Four iron forms could be defined : Fe silicate, well-crystallized oxides, poorly-crystallized oxides and amorphous iron, which respectively correspond to Fe total-Fe CBD ; Fe CBD-Fe oxalate ; Fe oxalate-Fe EDTA and Fe EDTA.

The comparison between the chemical and the Mössbauer diagnostics generally led to a good agreement in the mineral samples which were :

— Sample A : the clay fraction of the A₁ horizon of a "sol brun mésotrophe" developed on granite (presence of silicate Fe II, hematite and goethite).

— Sample B : the B horizon of a "sol ferrallitique" (magnetite and aluminous goethite).

— Sample C : the A_{2g} horizon of a hydromorphous soil (complementary interpretations of the two methods about interlayered iron of chlorites).

In the organic samples, when the ratio of organic matter was not too high, a relatively good agreement was still observed between the two technics (samples D and E which corresponded to natural ferrihydrite and the fine fraction of a Bs, spodic horizon). In the last sample (the B_h horizon of a podzol), rich in organic carbon and poor in total iron, the estimations of silicate Fe and amorphous iron were very different. The superiority of the chemical method was concluded for the study of the organic iron forms.

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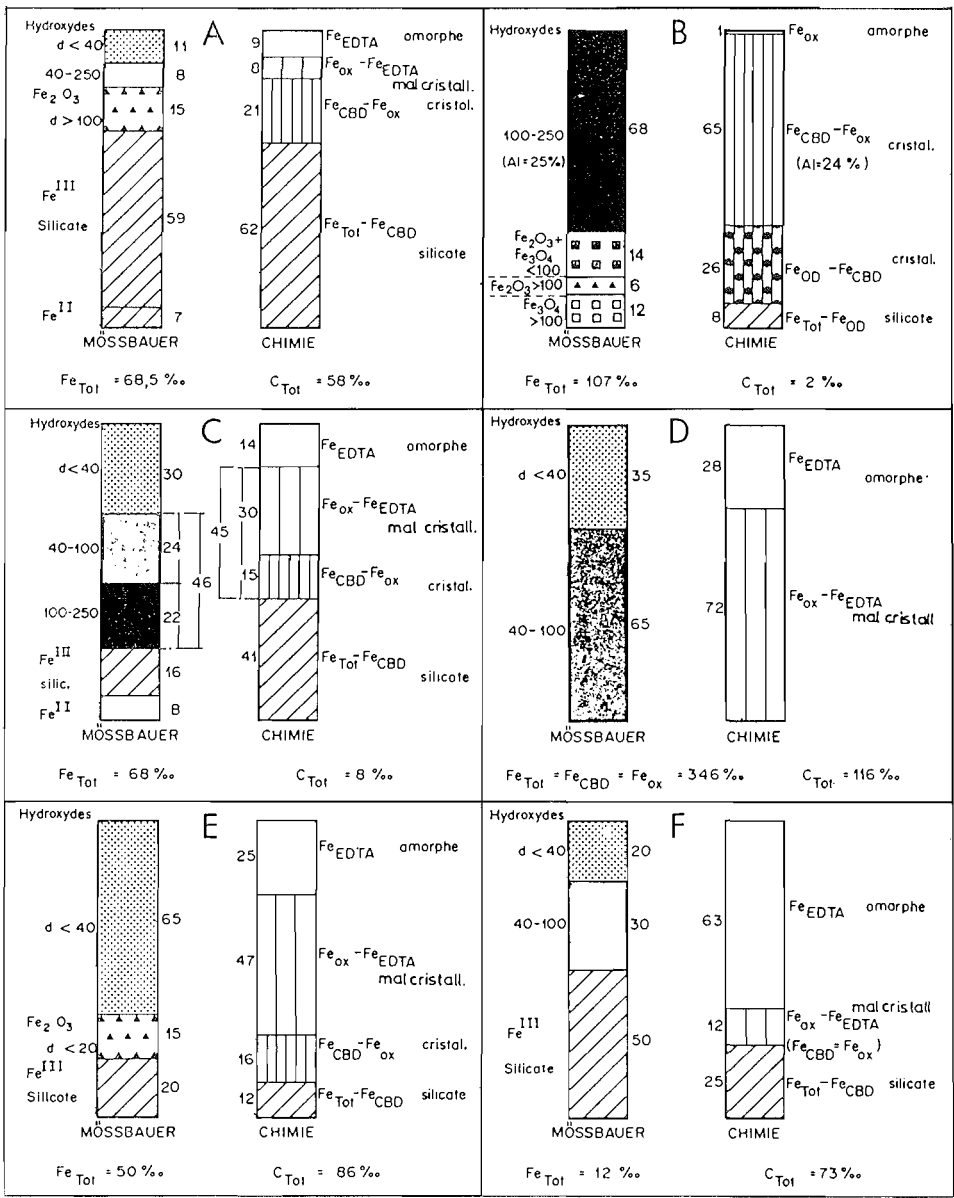


Figure 3 : States and forms of iron in per cent of total iron, analyzed by Mössbauer spectrometry and chemical extraction (crystallite size in Å).