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Clay Fabric of Very Fissile Paleozoic Gray Shales*

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The purpose of this paper is to report preliminary findings of an electron microscope study of the fabric of Paleozoic gray shales. Very few electron micrographs have been published which show in detail the actual clay flake orientation in very fissile shales, therefore, it is felt that such a study would be useful in determining factors which contribute to shale fabric and fissility.

Fissility is that characteristic which causes shale to split into thin layers, usually parallel to the bedding plane. Many workers (Ingram, 1953; Grim, Bradley, White, 1957; Gipson, 1965; and Odom, 1967) have studied the fabric of shales using petrographic or x-ray diffraction methods. White (1961) and O'Brien (1964) published x-ray diffraction traces of very fissile gray shales which indicated clay platelets are oriented with their C axis perpendicular to the fissility plane. It is concluded by most workers that the degree of fissility of shales is proportional to the degree of preferred clay flake orientation. Therefore, very fissile shales should be composed of clay flakes with the highest degree of preferred orientation. This author conducted a detailed electron microscope study of the surface morphology of a number of gray shales possessing well developed fissility in order to test the validity of this conclusion.

Each sample of shale was broken parallel to the fissile plane and the exposed surface cleaned with a fine brush. This surface was replicated first with a coat of platinum - palladium metal and then with carbon. The shadow angle was 90° and the sample was rotated during shadowing. Replicated specimens were placed into hydrofluoric acid, dissolving the clay and allowing the replica to float free. After remaining in the acid bath for two days, the replicas were washed in distilled water and mounted on copper grids.

Figure 1 shows the electron micrographs of the number of very fissile gray shales. X-ray data obtained by the author but not included in this paper reveal a high degree of parallelism of the clay flakes in these illitic shales. The electron micrographs corroborate this interpretation. The reader will notice that the clay flakes overlap like pages in a book and that there is a remarkably high degree of preferred orientation. This work supports the conclusion that the major cause of fissility is the parallel orientation of clay particles and is offered as additional evidence to corroborate conclusions previously reached from X-ray data.

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References cited

GIPSON, M., 1965, Application of the electron microscope to the study of particle orientation and fissility in shale: Jour. of Sedimentary Petrology, vol. 35, p. 408-414.

GRIM, R. E., BRADLEY, W. F., and WHITE, W. A., 1957, Petrology of the Paleozoic shales of Illinois: Illinois State Geological Survey, R. I. 203, 35 p.

INGRAM, R. L., 1953, Fissility of mudrocks: Geological Society of America Bulletin, vol. 64, p. 869-878.

O'BRIEN, N. R., 1964, Origin of Pennsylvanian underclays in the Illinois Basin: Geological Society of America Bulletin, vol. 75, p. 823-832.

ODOM, I. E., 1967, Clay fabric and its relation to structural properties in mid-continent Pennsylvanian sediments: Jour. of Sedimentary Petrology, vol. 37, p. 610-623.

WHITE, W. A., 1961, Colloid phenomena in sedimentation of argillaceous rocks: Jour. of Sedimentary Petrology, vol. 31, p. 560-570.

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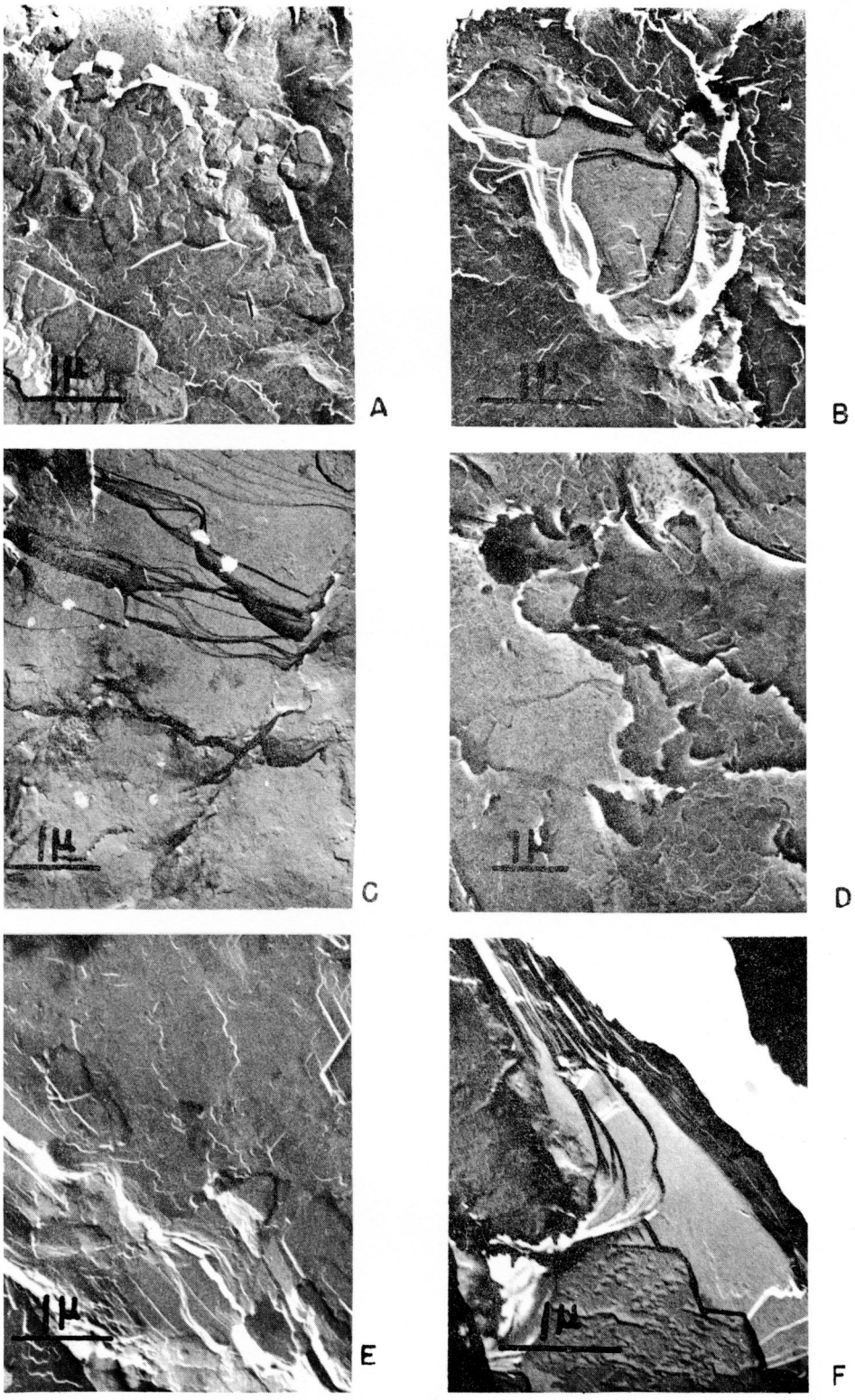

Fig. 1 - Electron micrographs of shales (a) Eau Claire shale (Cambrian) Champaign County, Illinois. (b) Maquokets shale (Ordovician) Cook County, Illinois. (c) Utica Shale (Ordovician) East Rodman, New York. (d) Cuyohoga Fm. (mississippi) Newark, Ohio. (e) Pennsylvanian gray shale, Illinois. (f) Roof shale of Herrin No. 6 coal (Pennsylvanian) Montgomery County, Illinois.