Ockham's Razor X-rayed—Part 1: Mechanism of Adsorption of Proteins on Clay Surfaces

William of Ockham (1300-49, 3) believed that it was futile to work with more entities when it was possible to work with fewer. Ockham expressed this principle in various ways throughout his works, a common form being: "A plurality must not be asserted without necessity." The well-known derogatory phrase *Entia non sunt multiplicanda praeter necessitatem* (e.g. entities must not be multiplied except by necessity), the so called, "Ockham's razor," was introduced only in the 17th century. To my (8) statement that the high d(001) spacings observed by McLaren et al. (11) could be accounted for by the swelling behavior of clays has been applied "Ockham's razor" by McLaren and Barshad (10) in their communication entitled, "Clays, proteins and nonsense." Sincerely speaking, I have no intention to suppress the idea about the possibility of adsorption of globular proteins in spherical form in the interlamellar space of layer silicates. However, as far as the results of McLaren et al. (11) are concerned I can explain them more coherently and in complete consistent with what I have already stated.

McLaren et al. (ref. 11, Table 2, p. 241) concluded that lysozyme is adsorbed by cation exchange mechanism. The very fundamental principle of cationic adsorption on clay surfaces is that the equivalence between charge of cations and charge of the clay is always maintained (12). Consequently, $M_{\text{max}}$ (ref. 11, Fig. 1, p. 240), regardless of its amount, at every adsorption isotherm should carry a charge equal to the charge of the clay and should arrange in petitor for large organic cations (6). Most proteins in $M_{\text{max}}$ might be due to both increased charge density of protein molecule with increased acidity (2) and increased ionic strength and the kind of buffer employed. They did not mention how the ionic strength and the kind of buffer influence the adsorption of proteins on clay surfaces.

McLaren et al. (11) assumed that in the initial step expansion there is a random interstratification. The adsorbed proteins in the interlayers of clays (9) allows for the type of random interstratification imagined by McLaren et al. (11). Only when the quantity of lysozyme offered for adsorption is greater than $M_{\text{max}}$ there will be no interstratification. Moreover, McLaren et al. (11) stated that the manner of adsorption of lysozyme is similar to the adsorption of water molecules and the adsorption of polar molecules. Polar molecules will fill the available space at every pH if quantity allowed to adsorb is not limited. But the adsorption of lysozyme under a given set of conditions of pH, buffer and ionic strength is almost constant regardless the quantity of lysozyme offered for adsorption (ref. 11, Fig. 1, p. 240). Therefore, random interstratification is not compatible with the manner of adsorption for protein and both are in contradiction with their own results.

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