The clay mineralogy of some soils from Johor, Malaysia

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The clay mineralogy of surficial materials from major geomorphic units in southeast Johore, Malaysia has been investigated. These geomorphic units consist of granitic, metavolcanic and metasedimentary residual terrains, Older Alluvium terrain and Holocene alluvium terrain. The mineralogy of the granitic and the metavolcanic residual terrains tend to be similar. Kaolinite, goethite, hematite and gibbsite are the dominant clay size minerals in the weathered zones of these terrains. Kaolinite, illite and goethite are the main clay size mineral in the weathered zones of the metasedimentary terrains. The mineralogy of the Older alluvium is predominantly kaolinite and goethite. The mineralogy of the Holocene alluvial tends to be similar to that of the granitic and volcanic residual terrains. These results show that there is a major influence of sedimentary environment and/or age on the clay mineralogy of these geomorphic units.

The properties of kaolinites and goethites have also been investigated in detail. From the XRD traces, kaolinite properties pertaining to crystallinity and unit cell parameters has been determined. Generally, the kaolinites consist of a high proportion of highly disordered kaolinites especially of the type with a monoclinic character (C3kaolinite), with a small portion of low defect kaolinite or none at all. Low asymmetry indices measured on the basal peaks suggest an absence of halloysite or its presence in very small quantity. The results on the basal spacings, asymmetry indices and width of half heights suggest that the kaolinite crystals are small. These observations were corroborated by scanning and transmission electron microscopy. A general trend relating kaolinite crystallinity index and basal spacing to parent material and hydromorphy was observed. Goethites were investigated for their Al-substitution, mean crystallite dimensions and specific surface area. The Al-substitution ranges from 6-37 mole %. The mean crystallite dimensions perpendicular to (111) ranges from 9.9-

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16.2 nm. The mean crystallite dimension perpendicular to (110) ranges from 12.8-18.5 nm. The results indicate that the goethites are generally small in size and highly substituted, indicating a free leaching environment of formation. The kaolinite and goethite properties of these soils were found to be typical of kaolinites and goethites found elsewhere in highly weathered terrains of the tropics.

Oxygen-18 isotope content of kaolinite and gibbsite in several bauxitic concretions from southeast Johore has also been investigated. The results of this study suggest that the bauxites were formed during a glacial period probably in the Pleistocene.