CORRESPONDENCE

The Secretary,
The Institution of Civil Engineers.

DEAR SIR,

In his Paper, "The properties of decomposed granite" (*Géotechnique*, 12:3:226–243), P. Lumb has sketched the formation, structure, and composition of soils residual from granite in Hong Kong as well as some of their engineering properties.

Except for some general remarks on climate and topography, no special attention was given to the environmental conditions under which weathering had taken place. A small area like that of Hong Kong, of course, does not provide the opportunity for studying the rôle played by many different types of environment, particularly climate, in the process of weathering, because basically different conditions can hardly be investigated and compared. This is not the case in a large country like South Africa and concentrated research effort has been devoted to this problem because of the great differences in the engineering performance experienced with weathered basic igneous rocks (Weinert, 1961(*b*))[1] in different regions.

The performance could be related the mode of natural weathering; being generally sound where distintegration occurs and generally unsound where decomposition predominates. As climate was thought to be the most important environmental factor in weathering, a special detailed study of its influence on decomposition and disintegration was made (Weinert, 1959; and 1961(*a*)). This led to the deduction of the climatic N-formula (Weinert and Clauss, 1962) as a simple expression for the interaction of those climatic factors which appeared to have the greatest influence on the mode and rate of weathering. This formula reads:

$$N = 12.E_J.P_a^{-1}$$

where E_J is the potential evaporation of the warmest month calculated from the Meyer formula (Linsley, Kohler, and Paulhus, 1949) and P_a is the total annual precipitation. The value $N=5$ was found to be the critical limit between predominating disintegration ($N>5$) and prevailing decomposition ($N<5$), provided the annual mean temperature was about 15°C or more.

The climatic index for Hong Kong, taking July as the warmest month, is:

$$N_{\text{Hong Kong}} = 0{\cdot}5$$

and the degree and depth of weathering is in full agreement with what would be expected in an area with this value. Unfortunately, the formation of kaolinite is not a good indicator in this regard because kaolinite would originate from a rock rich in orthoclase in all types of environment. A fair amount of allitic compounds (free alumina and silica) should be expected, however, under the conditions of Hong Kong. Clarity on the composition of the clay fraction would be obtainable by X-ray diffraction, supported by *differential thermal analyses* if necessary, and it would be interesting if the Author could provide further information. The microscopic determination of the percentage of secondary minerals is probably a more reliable means of indicating the degree of decomposition than the calculation suggested in the Paper. This percentage must be determined relative to all other minerals but quartz in the sample. More than 50% secondary minerals will most likely be found for the residual soils of Hong Kong. Three groups of minerals should be counted under the microscope at 60× to 80× magnification: (1) quartz, (2) all other primary minerals, i.e. feldspar, mica, hornblende, etc., and (3) all secondary minerals, i.e. those minerals whose presence in the sample is due to weathering. The technique of "point counting" is the preferable method. Microscopic slides or thin sections must be prepared for this purpose and several methods are available

[1] The references are given on p. 159.

for hardening soft materials, like soils. Similarly, the quantity of quartz and feldspar in the original fresh rock could be determined within a relatively short time by using microscopic point counting methods in a more accurate fashion than by the rough estimation of quartz: feldspar=1:2, given in the Paper. X-ray diffraction could again support estimates of the quartz/feldspar ratio.

The high porosity of parts of the soils is due to the extensive removal of secondary material without changing the soil structure. This may give rise to collapse on wetting under load (Brink and Kantey, 1961). Such soils are stable when dry but the strength can be lost spontaneously on inundation. The seasonally dessicated portions of the soil may, therefore, be a menace, particularly in regard to heavy structures and the Author's comment on whether he has encountered such problems would be useful. The collapsibility is, thus, a further engineering property of the residual soil which must be linked with compressibility and listed with permeability and shear strength. The *double oedometer test* (Jennings and Knight, 1957 (*a*)), provides a means of determining the potential degree of collapse (Jennings and Knight, 1957(*b*)). This is actually a series of consolidation tests carried out simultaneously on dry and wet samples from the same spot on the face of a quarry or test pit. Another simple test can be applied on the site: A dry hand specimen of the soil is wetted and compressed manually. Collapsibility is indicated by a considerable loss of volume without applying much force. It would be interesting to hear more of the Author's experience in regard to the possibility of such behaviour in the soils of Hong Kong.

Yours faithfully,
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January 1963.

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The Secretary,
The Institution of Civil Engineers.

Dear Sir,

ATTERBERG LIMITS

The Atterberg tests (determination of liquid and plastic limits) are the two most commonly used tests for classifying cohesive soils. Much has been written concerning test procedures and apparatus, but it remains a fact that nothing has been written concerning thier physical interpretation. If the Atterberg limits were used only for purposes of soil classification this