

NOTE ON CORRELATION OF PHYSIO- GRAPHIC STAGES

BY

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The definite nature of the faunal evidence afforded by the Nihowan beds is of importance in fixing the limits of the physiographic stages which till now have been somewhat hazily defined.

Two qualifications should be made at the outset.

(1) Since the duration and amount of those climatic variations and crustal adjustments responsible at any time for changes of conditions in North China are only imperfectly known, there is always a risk in generalizing from what may be comparatively local effects. But there is reason for believing that the Sanmenian stage as defined above represents a definite set of conditions that affected at least all of the provinces of Chihli and Shansi and extended beyond the Yellow River on the West.

(2) In attempting to link up the Tertiary and Quaternary history of China with what is known of the rest of the world, it should not be forgotten that there is no a priori reason why the terminal events of any period or stage recognized in Eastern Asia should coincide exactly with a correspondingly well-marked event elsewhere. In particular, the mixed nature of the Nihowan mammalian fauna suggests rather what would under other circumstances be called transitional or passage beds. As far as China is concerned, no object is served by trying to force the poor animals entirely either into the Pliocene or into the Pleistocene, since they themselves may not have recognized any such fine distinctions—claiming affinities in both directions!

The disruption of the *Pei-t'ai* peneplane in Middle Tertiary times gave rise to conditions of increased erosion. This *Tanghsien* stage produced a relatively mature erosion topography while climatic conditions favoured the growth of reworked residual deposits on the gentler slopes. With the exception of localized river-gravels (probably dating from upper Ex-Pliocene) the Red Clay is the only representative of the gap between the Miocene disturbances and the Sanmenian. For the most part it is unfossiliferous but Pontian types predominate in those spots where vertebrate remains have been found.

The Red Clay at the base of the Nihowan series may well fall within the period spanned by the Tanghsien stage.

The cause of the marked change indicated by the Sanmen Series is not definitely known. The facts however point to a relatively slight crustal disturbance, mainly of warping so as to cause extensive ponding in mature valleys, but locally perhaps involving faulting. The rocky bluff now buried in the Cheng-chia-wan platform may have some origin of this kind.

A parallel history to that of the *Sanmenian* stage is reported from Yunnan, Kuangtung and the Yangtze Valley, where widespread fluvio-lacustrine conditions followed erosion to maturity and preceded vigorous gorge-cutting. At present strict contemporaneity can neither be proved nor disproved as only in the Nihowan beds have satisfactory faunal indices been found.

In the Sangkanho Basin the Nihowan beds are cut through by powerful erosion that can be linked up with rock-cut terraces in adjoining river gorges. At present I am inclined to correlate this directly with the *Fenho* erosion period of Willis and Andersson, inspite of the fact that in Shensi and Kansu beds with Sanmen bivalves have been regarded as truly transitional basal members of the Great Loess. Further critical study is needed on this point in some Shansi locality where the relations of the Sanmen to the authentic *Fenho* stage are equally clear.

In North Chihli this erosion stage lasted from the close of the Sanmen, early in Lower Pleistocene times to the onset of the more arid Malan stage that produced the loess. In a threefold subdivision of the Pleistocene this would correspond to the bulk of the Lower Pleistocene and the early part of the Middle Pleistocene, which affords adequate time for the well-marked erosion effects observed.

Increase of moisture brought on the *Panchiao* stage with sharp dissection, torrential gully and stream-bed deposits alternating with layers of resorted loess.

The *Recent* history is one of alluviation and of erosion with Terrace cutting in the softer formations.