

# THE DEPOSITS OF THE SANG KAN HO VALLEY

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Despite a number of well-established conclusions there is much of the later Tertiary and Quaternary history of North China that is far from being clearly understood. The staff of the Geological Survey, Dr. J. G. Andersson and others have developed and extended the idea of the physiographic stages recognized by Willis and Blackwelder for the margins of the Yellow River plain. The members of the Third Asiatic Expedition are working on a parallel problem for the interior basins of Mongolia and have obtained evidence pointing to climatic changes along lines similar to those noted by Huntington in Central Asia.

In the drainage basin North of the Western Hills of Peking, the valleys of the Yang Ho (洋河) and Sang Kan Ho (桑乾河) and their tributaries show topographic features indicating clearly distinct stages in the erosional history of the area. Though in general these will have to be correlated with the physiographic stages previously recognized in North China\*, the region in question shows evidence of other minor stages. These lesser variations may



be due to locally controlled conditions, not involving any regional climatic fluctuation. For it must be borne in mind that the stages of Willis and Andersson have been worked out primarily in valley systems which debouch directly on to the plain and therefore have the sea as their base-level. Such stages are controlled in the main by changes of elevation and climate. But in enclosed mountain basins of any size there may be the additional factor of

\*See Yih, *Geology of the Western Hills*, Mem. Geol. Surv. China. A:1, p. 75 Peking, 1920.

the establishment of a local base-level either "self-contained" or determined by the altitude of the outflow across some resistant barrier. In the latter case if any such cause as river capture leads to the short circuiting of the drainage, the diverted headwaters may be rejuvenated, and show marked renewal of erosional power without any corresponding stage being noticeable in adjoining valley systems. Today the waters of Yang-Ho—Sang-Kan-Ho system drain through the gorges of the Hun Ho.

The gorge of the Hsiung Ho at Kalgan has evidence of seven physiographic stages. The most noticeable is the incised terrace at the entrance to the Hanoorpa Pass<sup>1</sup>. Similar terraces on a much grander scale form striking features of the entrance to the gorge of the Sang Kan Ho 2 miles S.E. of Ni Ho Wan. My first impression of the importance of these terraces and the extensive lake deposits with which their history is bound up, was confirmed by a subsequent visit of Père Licent, Director of the Musée Hoang-ho Pai-ho<sup>2</sup>.

Recent erosion has done much to dismember the terraces, but there is clear evidence of a pause in downward erosion at two levels in the soft Nihowan lake-beds and at two shelves cut in the hard-rock gorge. These two pairs of terraces will doubtless prove to correspond to each other, the level of the overflow determining the height of the erosional terrace of the lacustrine beds. The latter are clearly at least as old as the higher rock-cut terrace, since they formed behind its barrier; but it is not yet known whether the highest present surface of lake-beds is "constructional" or whether the sediments once stood still higher and were planed off during the first subsequent erosional stage. One reason for thinking that the Nihowan series may predate the highest erosional terrace is that they carry gypsum at levels considerably below that of the terrace; since gypsum implies relatively arid conditions, there cannot have been water over-flowing at the time these particular layers were being laid down, and hence there was no erosion taking place in a manner to cut the rock-shelf.

On the eroded upper surface of the Nihowan series there are beds of brownish loess which in two localities were observed to have stratified layers

1) See Barbour Bull. Geol. Soc. China. Vol. 3, No. 2, p. 161, fig. 4.

2) See E. Licent, "Terrasses du Sangkanho" Bull. Mus. H-H P-H, 1924

at the base. This deposit also produced fragments of *Struthiolithus*. As loess occurs at levels considerably below the higher terrace, the dissection of the latter must have occurred in an erosion period between the deposition of the Nihowan beds and the onset of the loess conditions. This tallies with observations made near Kalgan. It remains to be established whether the pre-loess erosion cut to below the present stream level or not. The youthful character of the gorges is against the latter, but near Kalgan true loess seems to occur at one point below the horizon of the lower terrace.

The cause of the ponding of the waters that formed the lake in which the Nihowan beds were laid down is not yet known. It may perhaps be sought in a barrier produced by disturbances in Miocene times. Judging from the slopes of the bed-rock spurs round the margin of the basin, the beds now exposed are only the upper members of a series, the basal strata of which are of greater age.

So far the only mammalian fossils found in the Nihowan beds are the fragmentary remains of *Rhinoceros*, *Bos*, *Elephas* and a cervid (the last two being among the material collected by Père Vincent); these are found in a condition of true petrification. The beds also carry a *Quadrula* with characteristic embossed surface near the umbo, similar to those found at Sanmen rapids by Dr. V. K. Ting, which Dr. Dall thinks to be probably Early Pleistocene. The range of this species is not known and the fragile gastropods and other fresh-water types in the same series (apparently identical with the forms found 80 ft. below ground level when lowering the caissons for the new bridge at the Governor's yamen in Tientsin) have still to be studied by Dr. A. W. Grabau. The discovery of further mammal types will certainly establish the exact date of the formation, setting it in its correct place between the Hipparion clay and the loess, and at the same time fixing the various physiographic stages. By comparison with other fresh-water deposits in North China it will be thus more possible to link up the climatic history of China during Pliocene and Pleistocene into a connected whole.