New views on age of the Salawusu Formation of Late Pleistocene in northern China

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Abstract: The Salawusu Formation in the Salawusu River basin of Inner Mongolia is a typical sequence of the Upper Pleistocene in northern China. However, there have been some different views about the division and age of stratigraphic facies since the establishment of the Salawusu Formation. According to the stratigraphic subdivision and dating of the Dishaogouwan section, it is thought that the fluviolacustrine-aeolian sand sequence from the Dishaogouwan section can be compared with loess, deep-sea deposit records and climatic fluctuations of glacial period. The Salawusu Formation of fluviolacustrine facies was formed in the last interglacial period from 140 to 70 ka BP, roughly corresponding to the fifth stage of deep-sea oxygen isotope, and developed in the same period as the palaeosol S₁ on the Loess Plateau; the aeolian sand of the Chengchuan Formation was formed in the last glacial period from 70 to 10 ka BP, constituting the heteropic geological body along with the Malan Loess on the Loess Plateau; the fluviolacustrine deposit and black soil of the Dagouwan Formation and the Dishaogouwan Formation was formed in the Holocene warm period from 9 700 to 3 000 a BP, or developed in the same period as the palaeosol S₁ on the Loess Plateau.

Keywords: Salawusu Formation, age, deep-sea oxygen isotope.

Since French scholars Teihard de Chardin P. and E. Licent erected the "Salawusu Formation" in the Salawusu River basin of Inner Mongolia in 1924, it has been viewed as standard strata of fluviolacustrine deposits of the Late Pleistocene in northern China, especially in North China¹¹.²². There exist four different opinions on age of the Salawusu Formation; namely, early Late Pleistocene³, mid-late Late Pleistocene⁴⁻⁷, late Late Pleistocene⁸ and the sixth stage of deep-sea oxygen isotope δ¹⁸O⁹. Clearly, a
correct definition of age of the Salawusu Formation is of great importance in understanding the relations between the Salawusu Formation and Malan Loess in northern China in combination with the climate of glacial period and ascertaining the living ages of Hetao Man and Salawusu animals.

1 Division of stratigraphic sequence and establishment of chronosequence

According to lithology, lithofacies and vertebrate fossil, Yuan[5] named the top lacustrine deposits of the Salawusu Formation the Holocene Dagouwan Formation. The Salawusu Formation was divided into upper fluvial deposit and lower fluvio-lacustrine deposit, which were believed to be middle and late parts of the Late Pleistocene in age respectively. Based on studies of Quaternary strata in the Salawusu River basin[3], the authors renamed the Heilu soil, secondary loess and aeolian sand resting on the Dagouwan Formation the Dishaogouwan Formation; the upper fluvial deposit of the Salawusu Formation the Chengchuan Formation dominated by aeolian sand; and confined the Salawusu Formation to its lower part dominated by fluvio-lacustrine deposit. In addition, the authors classified the yellow fine sand and loess beneath the bottom sand and gravel layer in the Salawusu Formation as the Middle Pleistocene deposits. In the middle and downstream basins of the Salawusu River the stratigraphic sequence is similar to that of Dishaogouwan section and is stably distributed. However, there exist some lateral differences between the Chengchuan Formation and the Salawusu Formation due to difference in morphologic site. The Chengchuan Formation gradually changed into aeolian sand intercalated with loess or loess with intercalated aeolian sand in the loess hill area and it gradually changed into Malan loess in the loess area; while the Salawusu Formation gradually changed into drab-soil-type palaeosol S1 in the loess hill area. Based on such a division of stratigraphic sequence in Dishaogouwan section, precisely stratified sampling and absolute age determination of typical Dishaogouwan sections (fig. 1) in the basin were conducted. The Middle Pleistocene aeolian sand has a TL age of (0.216 ± 0.022) Ma; middle-lower part of the Salawusu Formation (about 10 m above the bottom) is (93 000 ± 14 000) a in age[10], the top of the Salawusu Formation is (70 900 ± 6 200) a in age. Li[11] also studied the strata of the Milanggouwan section, about 5 km apart from north-