Memorandum of Understanding between

Research School of Arid Environment and Climate Change
Lanzhou University

and

Department of Soil Science, Gorgan University of Agricultural Sciences and Natural Resources

For Purposes of Joint Collaborative Efforts on Iran Loess Study

Purpose:

This memorandum of understanding (MOU) is intended to develop international collaboration and interdisciplinary research, education, training, and information exchange in areas of mutual interest in the fields of chronological and paleoenvironmental study of the late Cenozoic aeolian sedimentary sequences in northeastern Iran. This cooperative program is intended to promote an increased understanding of spatial and temporal evolution of Asian aridification as well as its forcing mechanism during the Cenozoic era.

Background:

The Asian aridification is one of the most prominent climate changes on earth during the Cenozoic era, which maybe associated with the retreat of the Para-Tethys Sea, the uplift of the Tibetan Plateau, and/or the Cenozoic global cooling. However, how and when these events occurred and the potential relations among them remain unclear, mainly due to paucity of sedimentary records in key regions. Aeolian sediment is a product of drying processes in the source regions; aeolian sedimentary archives thus are able to record the aridification history to some extent, and climatic variability during late Quaternary.

Through study of the so-called "red clay" formation and its overlying loess-paleosol sequences from the eastern Chinese Loess Plateau, it has become increasingly apparent that aridification in the Asian interior initiated at 7-8 Ma, and enhanced at 3.4 and 2.6 Ma. The recent discovery of Miocene loess sequences from the western Chinese Loess Plateau has extended the Chinese dust history back to 25-22 Ma. Nevertheless, sedimentary archives from the western Tarim Basin and North Pacific Ocean illustrated that aeolian deposits has existed across the whole Cenozoic with a stepwise increases in the mass accumulation rate. These findings have depicted a broad scenario of Asian

aridification history that is characterized by enhanced aridity through time and progressively spatial enlargement of arid area from source regions to downwind areas. Unfortunately, there remains lack of in-situ long-term aridification records from arid central Asia.

The precipitation/moisture changes in the arid central Asia under the westerlies circulation is also a hot topic in the palaeoclimate community. It was already found that climatic changes are out-of-phase or even anti-phase changes with that in monsoon Asia during Holocene. The typical situation is such as humid LIA and dry MWP during the recent 1000 years in arid central Asia, while LIA was quite dry with weak summer monsoon contrasting with humid climate with strong summer monsoon during MWP in monsoon Asia. It was proposed that the so-called "Westerlies climate regime" existed in westerlies-dominated arid central Asia, which further needed to be studied. Northern Iran provides a typical region for study climatic regime in arid central Asia. Loess-paleosol sequence could be used to understand climatic history during late Quaternary, especially Holocene and last glacial.

The Iranian Loess Plateau is located at the mid-latitude arid Asian region dominated today by the Westerlies, which is a key region for us to understand the history of Asian aridification and its forcing mechanism. But the geological history of aridification remains unclear, and high-resolution climatic history during late Quaternary in this region also requires further study. The understanding of paleoenvironmental evolution in this area is an enormously complex project, requiring coordinated interdisciplinary work using a variety of advanced methods and equipment. It also requires stable, vigorous research groups, efficient organization, and international cooperation. This agreement is intended to provide that organization and cooperation, and will enhance the study of temporal and spatial evolution of Asian arifidifcation, late Quaternary climatic history as well as its forcing mechanism during the Cenozoic.

Programs:

1. Joint fieldwork in the frame of the agreed research project in northern Iran. The participators from Lanzhou University are responsible for all the cost related to the fieldwork. Samples for geochronology and paleoenvironment will be collected and will need to be shipped back to the CHN with the pertinent paperwork arranged by participator from Gorgan University of Agricultural Sciences and Natural Resources.

2. Joint support for exchange of Iranian and Chinese faculty and students for research, teaching, and study abroad opportunities. The costs for the exchange of scientists will be applied to the relevant funding available.

3. Development of specific substantive research projects in fields of mutual interest including (but not limited to):

- Nature, origin, and spatial distribution of red clay formation and its overlying Quaternary loess-paleosol sequences in northeastern Iran.
- High-resolution chronological frame for typical aeolian sequences in Iranian Loess Plateau.
- High-resolution multi-proxy climate records from the late Cenozoic aeolian sedimentary archives, the late Quaternary loess-paleosol sequences, and surface samples in northeastern Iran.
- Relation between the accumulation of aeolian deposits in central Asia and the retreat of Para-Tethys Sea.
- Precipitation/moisture history and regime during late Quaternary, especially Holocene and last glacial in northern Iran.
- Samples for geochronology and paleoenvironment will be collected and will need to be shipped back to the CHN with the pertinent paperwork arranged by Gorgan University of Agricultural Sciences and Natural Resources.

All abovementioned studies could only be done in case of mutual interest.

4. Joint organization of workshops, symposia, international conferences and publications.

Conditions:

1. The institutions signatory to this MOU will arrange for joint support of personnel and programs operating under this MOU on a case-by-case basis by written agreement.

2. This agreement shall be effective once it is signed by representatives of all participatory institutions.

3. All institutions will review the agreement on an annual basis. This MOU is valid for a period of five years from the date of signature. It may be renewed by mutual written consent of both institutions.

4. Any signatory institution may withdraw from the agreement by a written notice to the other parties. Amendment or termination of the agreement becomes effective three months after the date of the written notification

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