GEOMORPHOLOGICAL RESEARCH IN SANJIAN PLAIN 2006

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1. INTRODUCTION

The dissolved iron in watersheds is supplied from soil and bedrock whose chemical and physical properties influence the dissolution rate of iron and vary with regional environmental factors. Geomorphological condition is one of the important factors affecting the properties of soils and sediments, and the spatial distribution of soil and related environmental characteristics are vital for understanding the sources of iron. The processes of soil and sediment formation control their characteristics, and the spatial distribution of the characteristics of soils and deposits can be inferred by uncovering the process by which each geomorphological unit is formed. Thus, we began by analyzing the topography of the Amur River basin, and because fluvial deposits record recent environmental changes in the watershed, including the impact of human activities, we sought to reconstruct the historical environmental changes in the Amur River basin using the floodplain sediment, which provided information on past environmental variations in the catchment.

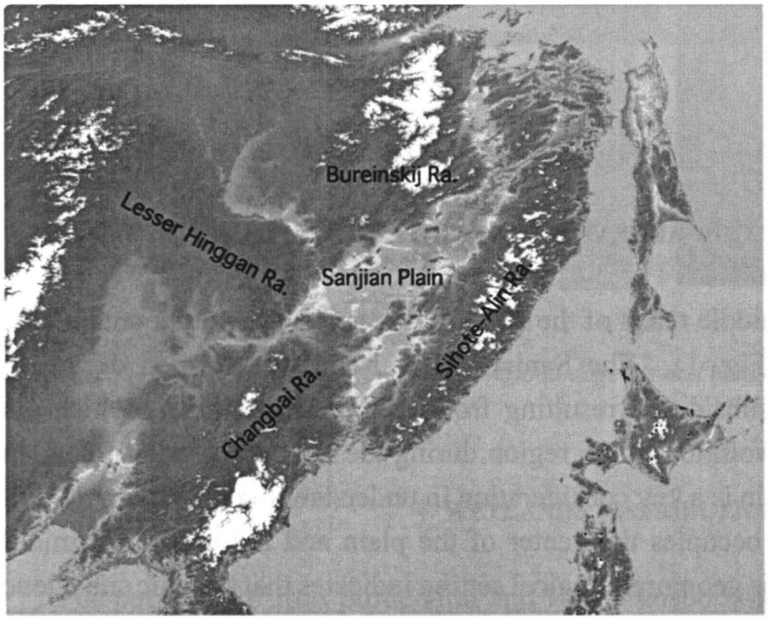

Figure 1. Topography of the middle and lower reaches of the Amur River.

2. METHODS

In 2006, we focused on the Sanjian Plain in Northeast China. We analyzed its topography and wetlands with remote sensing, and developed a preliminary geomorphological classification map of the Sanjian Plain. Geomorphological land classification mapping is basis of research directed toward classifying land cover change and investigating fluvial processes. The map classifications are then compared and verified with actual ground observations in the field.

The field survey was conducted during 19–29 September 2006 in the Sanjian Plain with the cooperation of the Northeast Institute of Geography and Agricultural Ecology, Chinese Academy of Sciences. We investigated soil and sediment profiles in each topographic unit throughout the Sanjian Plain unit and collected continuous, 2–3-m sample profiles from outcrops or sediment cores using hand boring equipment and a geoslicer (Photo 1).

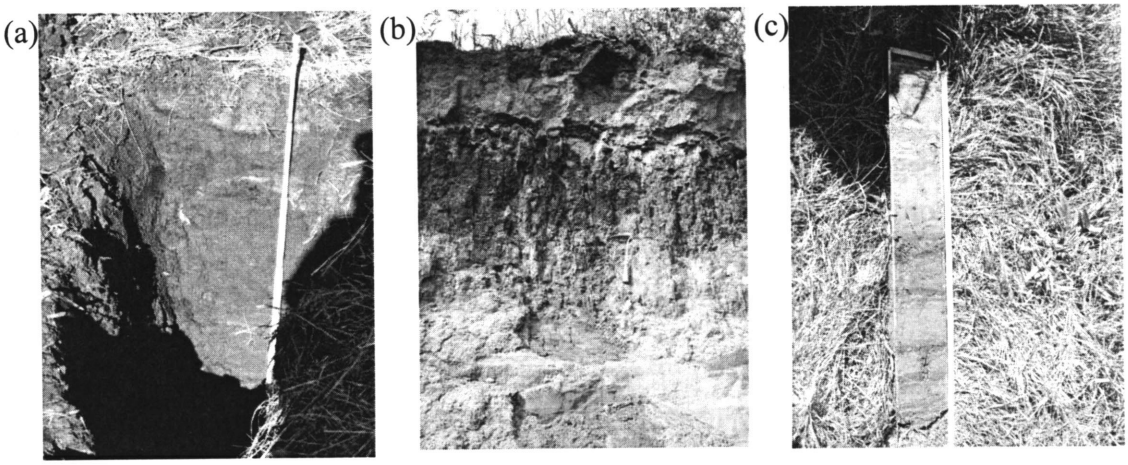

Photo 1. Soil and sediment profiles of a pit (a) and an outcrop (b). (c) Geoslicer.

3. GEOMORPHOLOGICAL FEATURES OF THE SANJIAN PLAIN

The Sanjian Plain is in the middle reach of the Amur River and is an intermountain basin formed by tectonic movement (Fig. 1). The Sanjian Plain basin was formed during the Quaternary period by intensive subsidence resulting from tectonic movements, which also influenced the geomorphologic evolution of the region during the Holocene epoch. Thus, the geomorphology of the alluvial plain is a key consideration in understanding the region's fluvial processes. A large swampy area occupies the center of the plain and the upper and middle terraces surrounding the plain. This geomorphological setting indicates that tectonic subsidence has been continuous since the early Quaternary.

Although the alluvial surface in the basin is extremely flat, several levels of fluvial terraces were identified. The geomorphology of the Sanjian Plain is classified into nine categories: mountain and hill, upper terrace, middle terrace, lower terrace, terrace-incised valley, residual river course, natural levee, floodplain, and the present river floor. Each terrace could be further

subdivided into several levels. The lower terrace occupies a large area of the Sanjian Plain basin and the present meandering river shallowly dissects the surface.

Peat sediments occur on each surface (Fig. 2). The peat layer on the middle terrace is covered by eolian loess and is completely decomposed (Figs. 2–6). The terrace is additionally composed of thick gravel deposits. Thus, the middle terrace is assumed to have been formed during the last glacial period.

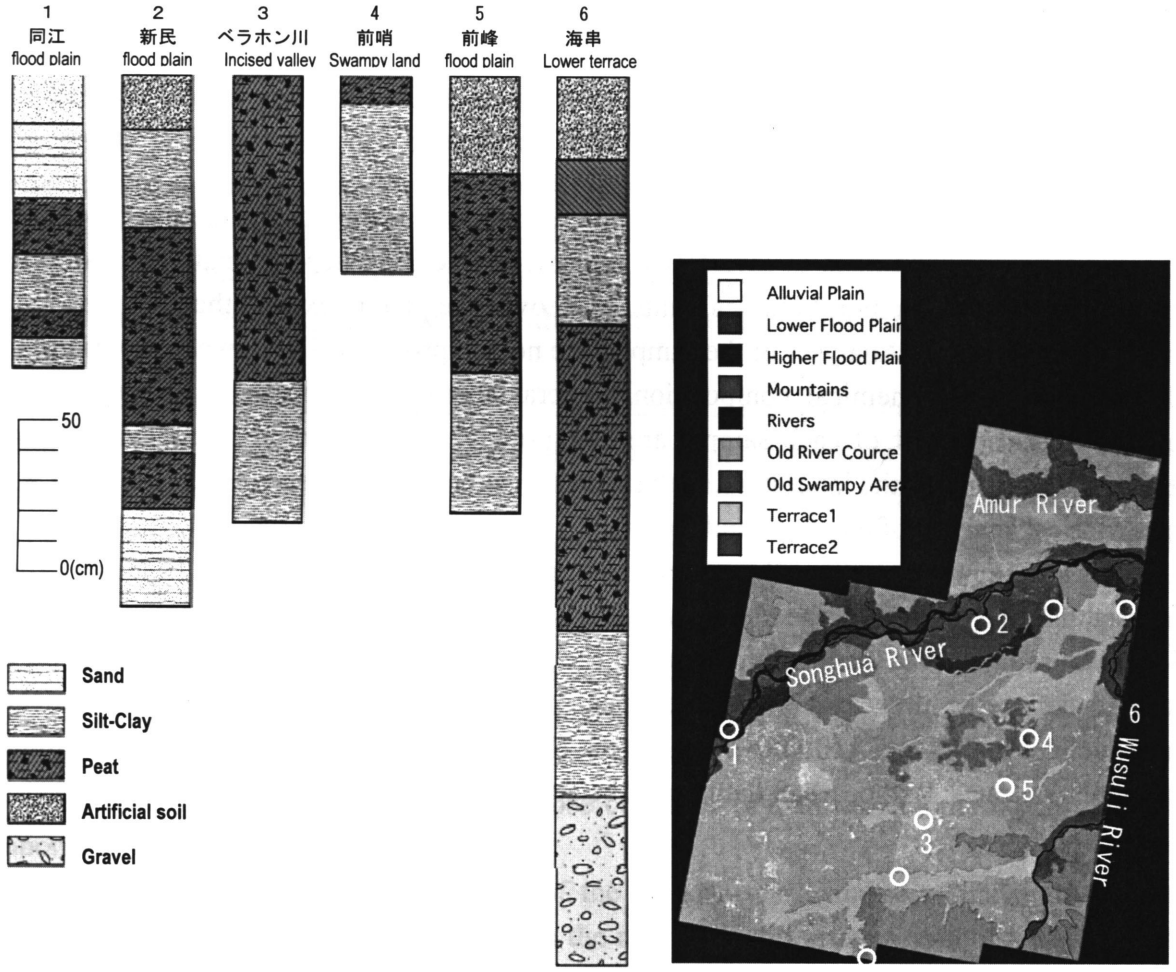

Fig. 2. Columnar sections of fluvial and wetland deposits and the geomorphologic classification map of the Sanjian Plain.

4. WETLANDS DISTRIBUTION

For purposes of iron production and river transportation, swamps and wetlands are the topographical units of greatest interest. As a large area of the Sanjian Plain is occupied by wetlands, the plain is important for the production and transport of iron to the main Amur River. However, the wetlands area in the Sanjian Plain has been decreasing rapidly in recent years because of farmland encroachment.

The wetlands are located on terraces covered by clay sediments and on the floodplains and

incised valley floor. Peat sediments occur in most of the wetlands, and the thickness of the peat deposits varies with the topography. Most of the peat deposits forming at present on the floodplains along Heillonjian, Songhua, and Wusuli rivers are less than several tens of centimeters thick. In contrast, thick peat deposits are found on the incised valley floor.

Recent coarsening of fluvial deposits occur at many localities on the floodplain along the Heillonjian, Songhua, and Wusuli rivers, where peat and silt–clay layers are covered by sandy deposits (Figs. 2-1 and 2-2). This is thought to be caused by farmland exploitation in the hilly terrain and indicates that the interruption of peat formation and the decay of wetland pose continuing problems.

5. FUTURE STUDY

We require additional verification on the ground to complete the geomorphological classification map, and need to investigate the soil profiles and depositional composition of currently undefined geomorphological units. Moreover, we plan to expand the map area in the downstream direction. Analyses of the samples are now in progress. The downcore variation in physical properties, chemical composition, mineral composition, magnetic properties, and micro-charcoal content of each sample are being analyzed to ascertain paleoenvironmental changes. The result of the laboratory analyses of the sediment samples will be combined with the historical analysis of the maps and data.

It is also important to trace the sediment sources in studying variations in these properties. To establish the source of the floodplain deposits, we will compare the properties of the floodplain sediments of the Sanjian Plain and each branch of the Amur River. Furthermore, we need to define the time axis for the sediment profiles. We plan to use the environmental radionuclides 137Cs and 210Pb to establish the chronology and to estimate average sediment accumulation rates. Radiocarbon dating will be applied as needed.