COPPER AND ZINC BALANCE IN SOILS, RICE PLANTS AND AQUATIC SYSTEMS IN AN AREA ALONG THE FUCHU PRECIPICE LINE, TOKYO, JAPAN

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Abstract. The abundance and distribution of Cu and Zn in spring water, irrigation water and sediment from the Fuchu Irrigation Canals, ground water for irrigation, rice plants and paddy soil at Tokyo University of Agriculture and Technology's Hommachi Farm were studied. The balance of Cu and Zn in the paddy field at the Hommachi Farm was investigated. The discharge of Cu and Zn influenced by human activities was observed in sediment of the Fuchu Irrigation Canal, and rice plants and paddy soil at the Hommachi Farm where irrigation water from the Fuchu Irrigation Canal was used until 1970. From Cu and Zn balance calculated, several hundred years are needed to decrease by half the present level of these metals at the Hommachi Farm.

1. Introduction

The Fuchu Precipice Line, which is located at the southern end of the Tachikawa Terrace, is characterized by three geomorphic and geological features, the Tachikawa Terrace, the Fuchu Irrigation Canals and the flood plain along the Tama River (Figure 1). This area was uplifted about 30,000 yr ago, so that the Tama River moved to the south after forming a flood plain which is called the Tachikawa Terrace. At present, the Tama River flows through a new flood plain, the Tama Lowland Plain, and deposits alluvial materials. The flood channels on the Tama Lowland Plain were formed by flooding many times. The Fuchu Irrigation Canals are used to drain as flood channels. Dystrandepts with a thickness of 3 to 5 m on the Tachikawa Terrace resulted from the eruption of Mt. Fuji in the Holocene.

The land on the Tama Lowland Plain, which spreads out to the south of the Fuchu Precipice Line, was typically used for paddy fields until the 1950's. However, intensive human activities around this area has reduced the paddy field area. This situation probably has been brought about by national economic growth associated with industrialization. Irrigation water from many springs and the Tama River yielded a high production of rice in this area. More intense landform modification for urban development commenced around 1960, resulting in a large amount of sewage discharge from factories and residences into the water in the Fuchu Irrigation Canal.

Tokyo University of Agriculture and Technology's Hommachi Farm is located in the center part of the Tama Lowland Plain. Before the Second World War, rice cultivation was carried out using water from one of the Fuchu Irrigation Canals.

However, since 1960, there has been remarkable N eutrophication; therefore, in 1964, a deep well was drilled at the Hommachi Farm to obtain unpolluted ground water. Ground water was mixed with water from one of the Fuchu Irrigation Canals from 1965 to 1970. In October 1970 Cd pollution was reported in one of the Fuchu Irrigation Canals (Fuchu City, 1978), and from then only ground water was used for irrigation.

The purpose of this study is to elucidate the abundance and distribution of Cu and Zn in the soil, rice plants and aquatic system of the area along the Fuchu Precipice Line and to estimate the balance of Cu and Zn in the polluted paddy field.

2. Materials and Methods

2.1. WATER, SEDIMENT AND SOIL SAMPLES

Water, sediment and soil samples were taken from 1982 to 1985 at monthly intervals. The spring water from the Tachikawa Gravel Layer were collected at 1-43, Nishifucho, Fuchu, Tokyo (NS in Figure 1). Water and sediment samples from the Fuchu Irrigation Canal were taken at 1, Yaho, Kunitachi, Tokyo (YH), which is 30 m