BIOGEOCHEMICAL TRANSPORT OF IRON FROM TERRESTRIAL ECOSYSTEMS IN THE THREE RIVERS PLAIN OF NORTHEAST CHINA TO NEARBY WATERS: RESEARCH PROPOSAL

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OBJECTIVES

The shortage of dissolved Fe is one of the main factors limiting the primary productivity in the Okhotsk Sea and the northern North Pacific, while the changes of land use patterns nearby deeply affect the Fe input of these waters. The Three Rivers Plain in Heilongjiang Province of Northeast China abuts Okhotsk Sea. In the past 50 years land reclamation, the mean annual increment of cultivated land in this Plain was 84,000 hm^2, while the mean annual decrement of wetland was 86,000 hm^2, resulting in a marked decrease of soil Fe output because of the shifts of soil physical, chemical and biological properties.

Our research is aimed to approach the Fe forms and their distribution in the main soil types of the Plain, explore the mechanisms of Fe differentiation and migration in the soil profiles under effects of land use patterns changes, and estimate the contribution of soil Fe output to the nearby waters Fe content.

RESEARCH CONTENTS

1. *Fe forms and their distribution in soil profiles*

Select cultivated and virgin meadow soil, albic soil and bog soil in the Three Rivers Plain of Northeast China as test soils, and determine the contents of total Fe, Fe^{2+}, Fe^{3+}, dissolved Fe and organo-Fe in their different layers (0-20, 20-40, 40-100 cm and deeper) and horizons (A, B, B/G, G, C).

2. *Mechanisms of Fe differentiation and migration in soil profiles under effects of land use patterns changes*

With forest soil, upland crop soil, lowland rice soil, and different use bog soil as test soils, determine the physical, chemical and biological properties of each soil layer and horizon, and approach their relationships with different soil Fe forms.

3. *Contribution of soil Fe output to nearby waters Fe content*

Determine the dissolved and organo-Fe in the water samples collected from surface runoff, different soil layers and horizons, and main outlets of farmland drainage system, and estimate the Fe output from surface runoff, soil side leaching and leaching to nearby waters.

EXPECTANT ACHIEVEMENTS

1. Know of the shifts of Fe forms in main soil types of the Three Rivers Plain after reclamation.

2. Make clear the physicochemical and biological mechanisms of soil Fe transformation and migration under land use patterns changes.

3. Learn about the decrement of soil Fe discharged to nearby waters after land use patterns changed.

4. Put forward feasible countermeasures in mitigating the decrement of soil Fe output.

TIME SCHEDULE

2005:

Selection of sampling sites;

Descriptions of surrounding landscape, reclamation history and land-use patterns, agricultural practices, and soil profiles;

Soil and water samples collection;

Soil basic properties analysis

2006-2007:

Laboratory work

2008-2009:

Data synthesis;

Supplementary determinations if necessary;

Writing reports

DETAILED RESEARCH CONTENTS

1. *Profile study on soil iron forms and other properties under different land use patterns (wetland, forestland, paddy field, upland field, etc.) and reclamation histories*

The test soil types will be meadow soil, albic soil and bog soil, with each soil type addressed at least two regions and duplicated sampled per each region. Soil samples will be collected from different layers (0-20, 20-40, 40-100 cm and deeper) and horizons (A, B, B/G, G, C), and the items to be analyzed are pH (H_2O), pH (KCl), Eh, moisture regime, total iron, Fe^{2+}, Fe^{3+}, dissolved Fe, organo-Fe, isotope ratio of Fe, total carbon and its $^{14}C/^{12}C$, humic acids, total nitrogen, total Si, Al, Ca, Mg, K, Na, P and Mn, acid-soluble Mn, Cl^-, NO_3^-, SO_4^{2-}, Na^+, K^+, Ca^{2+}, Mg^{2+}, NH_4^+, ferrobacteria populations, and ferri-reductase and ferro- oxydase activities

2. *Transect study of soil water and solute movement toward nearby waters*

Three profiles of each test soil types at two sites with different distances to a main drain ditch will be selected, and soil water samples will be collected basically every 30 cm from the

surface to a depth of 5 meters 3-4 times a year (*e.g.*, soil melting season, mid-summer, and autumn). At the same time, water samples from the drain ditch will be taken.

The items to be analyzed are pH, total iron, Fe^{2+}, Fe^{3+}, dissolved Fe, organo-Fe, isotope ratio of Fe, dissolved organic carbon and its $^{14}C/^{12}C$, dissolved nitrogen, NH_4^+, NO_3^-, NO_2^-, PO_4^-, Cl^-, SO_4^{2-}, Na^+, K^+, Ca^{2+}, Mg^{2+}, Mn (II), and Si. Soil ground water table and soil hydraulic conductivity around ground water depth will be also determined to detect the gradient of ground water table and to quantify the solute movement.

3. *Calculations of soil Fe output to nearby waters Fe content*

Based on the above-mentioned measurements, calculations of soil Fe output will be made to quantify the contribution and affecting factors of soil Fe output to nearby waters Fe content

Personnel be concerned with

3 professors
1 associate professor
4 associate researchers
3 Ph D postgraduates

Personnel intercommunion

2005:

Designate 4 associate researchers to related institutes in Japan to master unified advanced methodologies.

2006-2009:

Hold seminars each year in China and/or Japan.