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Nitrate Attenuation Processes in Groundwater at an Upland Slope-Wetland Plot

Seiichiro IOKA

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寄贈
井岡聖一郎氏

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Contents

| | |
|--|-----------|
| Abstract | iii |
| List of Tables | iv |
| List of Figures | v |
| Chapter 1 Introduction | 1 |
| 1.1 Objectives | 1 |
| 1.2 Outline of the present study | 3 |
| Chapter 2 Descriptions of study plot | 4 |
| 2.1 Location of study plot | 4 |
| 2.2 Climate | 4 |
| 2.3 Topography | 4 |
| 2.4 Geology | 7 |
| 2.4.1 Recharge area | 7 |
| 2.4.2 Upland slope-wetland plot | 12 |
| 2.5 Human activity | 12 |
| Chapter 3 Instrumentation, sampling, and analysis | 17 |
| 3.1 Drilling and installation of piezometers and observation wells | 17 |
| 3.2 Sampling of groundwater | 18 |
| 3.3 Chemical analysis of groundwater samples | 21 |
| Chapter 4 Hydrogeology in recharge area | 23 |
| 4.1. Hydraulic head | 23 |
| 4.2. Groundwater geochemistry | 26 |
| Chapter 5 Groundwater flow at the upland slope-wetland plot | 29 |
| 5.1 Introduction | 29 |
| 5.2 Configuration of water table at the upland slope-wetland plot | 31 |
| 5.3 Groundwater flow in the sand and gravel layer at the upland slope-wetland plot | 37 |
| 5.3.1 Hydraulic head in piezometers | 37 |
| 5.3.2 Direction of groundwater flow in the sand and gravel layer | 38 |
| 5.4 Groundwater flow paths along the transect at the upland slope-wetland plot | 46 |
| 5.4.1 Distributions of hydraulic head along the transect | 46 |
| 5.4.2 Oxygen-18 values in groundwater along the transect | 51 |
| 5.4.3 Chloride concentrations in groundwater along the transect | 55 |
| 5.5 Summary of groundwater flow at the plot | 60 |
| Chapter 6 Nitrate plume in groundwater at the upland slope-wetland plot | 63 |
| 6.1 Introduction | 63 |
| 6.2 Configuration of nitrate plume in groundwater at the upland slope-wetland plot | 65 |
| 6.3 Summary of nitrate plume in groundwater at the plot | 70 |

| | |
|---|------------|
| Chapter 7 Distribution of nitrate attenuation process-related constituents in groundwater at the upland slope-wetland plot | 72 |
| 7.1 Introduction | 72 |
| 7.2 Groundwater geochemistry at the plot | 73 |
| 7.2.1 Distribution of ammonium concentrations in groundwater | 73 |
| 7.2.2 Distribution of dissolved inorganic carbon concentrations in groundwater | 77 |
| 7.2.3 Distribution of sulfate concentrations in groundwater | 77 |
| 7.2.4 Distribution of pH concentrations in groundwater | 77 |
| 7.2.5 Distribution of Mn ²⁺ concentrations in groundwater | 87 |
| 7.3 Summary of groundwater geochemistry | 91 |
| Chapter 8 Discussion | 92 |
| 8.1 Relationship between groundwater flow paths and distribution of nitrate concentrations | 92 |
| 8.2 Nitrate attenuation processes in groundwater zone | 95 |
| 8.2.1 Nitrate attenuation processes in aquitard | 95 |
| 8.2.1a Geology, hydraulic head, and groundwater flow | 95 |
| 8.2.1b Distribution of nitrate and specific electrical conductance | 96 |
| 8.2.1c Nitrate attenuation processes in aquitard | 96 |
| 8.2.2 Nitrate attenuation zone in interface between the loam layer and the sand and gravel layer | 103 |
| Chapter 9 Conclusions | 123 |
| Acknowledgements | 125 |
| References | 126 |

Abstract

In the upland slope-wetland plot of about 300m² in area, detailed study was conducted to clarify relationship among groundwater flow paths, distribution of NO₃⁻ concentrations, and NO₃⁻ attenuation processes. The results are summarized as follows.

(1) Nitrate concentrations in groundwater were attenuated in the upland slope. There are two NO₃⁻ attenuation zones. One is NO₃⁻ attenuation zone in the deeper silt and clay layer of unweathered sediments. The other is NO₃⁻ attenuation zone in the interface between the loam layer and the sand and gravel layer. Furtherer, NO₃⁻ attenuation zone in the interface between the loam layer and the sand and gravel layer locates the place where gradient of water table is below 0.2 and the height from boundary between the loam layer and the sand and gravel layer is within 10cm. However, nitrate was not attenuated in the shallowest part of loam layer.

(2) Nitrate is attenuated in the deeper silt and clay layer of unweathered sediments in N3 as groundwater flow from the sand and gravel layer is directed downward. On the other hand, NO₃⁻ attenuation zone in the interface between the loam layer and the sand and gravel layer will be formed by more anaerobic groundwater from the deeper layer.

(3) Considered groundwater geochemistry, NO₃⁻ attenuation process in the deeper silt and clay layer is denitrification. The denitrification will occur in anoxic micro sites because the bulk groundwater may not be well anoxic condition. On the other hand, NO₃⁻ attenuation processes in interface between the loam layer and the sand and gravel layer at N1-N2 are dilution, denitrification, dissimilatory nitrate reduction to ammonium, and microbial assimilation into biomass.

Key words: upland slope-wetland plot, nitrate attenuation zone, water table gradient, groundwater flow path, unweathered sediments

List of Tables

1. Summary of the stratigraphy in the Tsukuba upland · · · · · 11

List of Figures

| | |
|---|----|
| 1. Location of the study area | 5 |
| 2. Climatic conditions at Tsukuba | 6 |
| 3. Map of the topography and land use in the study area | 8 |
| 4. Vertical cross section along transect R-D with land use and topography | 9 |
| 5. Geological column, matrix color and piezometer nest at label W in recharge area shown by Figures 3 and 4 | 10 |
| 6a. Geology in transverse transects of study plot and the locations of piezometer and observation well for measuring groundwater level and water table | 14 |
| 6b. Geology in transverse transects of study plot and the locations of piezometer and observation well for measuring groundwater level and water table | 15 |
| 7. Geology along the transect and the boundary between weathered and unweathered sediments | 16 |
| 8. Design of observation well and piezometer | 19 |
| 9. A map showing the location of piezometers and observation wells and topography at the upland slope-wetland. | 20 |
| 10. Vertical profiles of hydraulic head and δO^{18} values of groundwater in recharge area | 24 |
| 11. Variations of hydraulic head in recharge area | 25 |
| 12. Vertical profiles of pH, SEC and ORP in recharge area | 27 |
| 13. Vertical profiles of constituent concentrations of groundwater in recharge area | 28 |
| 14. Triangular elements used for making water table contours. | 32 |
| 15a. Configuration of the water table at the upland slope-wetland plot | 33 |
| 15b. Configuration of the water table at the upland slope-wetland plot | 34 |
| 15c. Configuration of the water table at the upland slope-wetland plot | 35 |
| 15d. Configuration of the water table at the upland slope-wetland plot | 36 |
| 16. Locations of piezometer nest used shown in Figure 17 | 39 |
| 17a. Hydraulic head distribution along vertical profiles of N1 and N2 | 40 |
| 17b. Hydraulic head distribution along vertical profiles of N3, N4, N5, and N6 | 41 |
| 18a. Lines of equal hydraulic head in the sand and gravel layer at the upland slope-wetland plot | 42 |
| 18b. Lines of equal hydraulic head in the sand and gravel layer at the upland slope-wetland plot | 43 |
| 18c. Lines of equal hydraulic head in the sand and gravel layer | |

| | |
|---|----|
| at the upland slope-wetland plot | 44 |
| 19. A map showing the transect from the configuration of water table at the upland slope-wetland plot | 45 |
| 20a. Groundwater equipotential lines [m] along the transect in relation to the geology | 47 |
| 20b. Groundwater equipotential lines [m] along the transect in relation to the geology | 48 |
| 20c. Groundwater equipotential lines [m] along the transect in relation to the geology | 49 |
| 21. Two pathways inferred from groundwater flow patterns | 52 |
| 22a. Distribution of δO^{18} [‰] in groundwater along the transect in relation to the geology | 53 |
| 22b. Distribution of δO^{18} [‰] in groundwater along the transect in relation to the geology | 54 |
| 23a. Chloride concentration contour lines [mg/L] of groundwater along the transect in relation to the geology | 57 |
| 23b. Chloride concentration contour lines [mg/L] of groundwater along the transect in relation to the geology | 58 |
| 23c. Chloride concentration contour lines [mg/L] of groundwater along the transect in relation to the geology | 59 |
| 24. Pathways of upward component from the sand layer to the loam layer inferred from chloride concentration contour lines | 61 |
| 25. Groundwater flow paths along the transect in relation to the geology | 62 |
| 26a. Nitrate concentration contour lines [mg/L] of groundwater along the transect in relation to the geology | 66 |
| 26b. Nitrate concentration contour lines [mg/L] of groundwater along the transect in relation to the geology | 67 |
| 26c. Nitrate concentration contour lines [mg/L] of groundwater along the transect in relation to the geology | 68 |
| 27. Fluctuations of 5mg/L contour line of nitrate in groundwater at the upland slope-wetland plot | 71 |
| 28a. Distribution of ammonium concentrations [μM] in groundwater along the transect in relation to the geology | 74 |
| 28b. Distribution of ammonium concentrations [μM] in groundwater along the transect in relation to the geology | 75 |
| 28c. Distribution of ammonium concentrations [μM] in groundwater along the transect in relation to the geology | 76 |
| 29a. Distribution of dissolved inorganic carbon concentrations [μM] in groundwater along the transect in relation to the geology | 78 |

| | |
|---|-----|
| 29b. Distribution of dissolved inorganic carbon concentrations [μ M] in groundwater along the transect in relation to the geology | 79 |
| 29c. Distribution of dissolved inorganic carbon concentrations [μ M] in groundwater along the transect in relation to the geology | 80 |
| 30a. Sulfate concentrations contour lines [mg/L] of groundwater along the transect in relation to the geology | 81 |
| 30b. Sulfate concentrations contour lines [mg/L] of groundwater along the transect in relation to the geology | 82 |
| 30c. Sulfate concentrations contour lines [mg/L] of groundwater along the transect in relation to the geology | 83 |
| 31a. Distribution of pH in groundwater along the transect in relation to the geology | 84 |
| 31b. Distribution of pH in groundwater along the transect in relation to the geology | 85 |
| 31c. Distribution of pH in groundwater along the transect in relation to the geology | 86 |
| 32a. Distribution of Mn^{2+} concentrations [μ M] in groundwater along the transect in relation to the geology | 88 |
| 32b. Distribution of Mn^{2+} concentrations [μ M] in groundwater along the transect in relation to the geology | 89 |
| 32c. Distribution of Mn^{2+} concentrations [μ M] in groundwater along the transect in relation to the geology | 90 |
| 33. Distribution of nitrate attenuation zone in groundwater along the transect in relation to the geology. | 94 |
| 34. Geological column and piezometer nest in recharge area and N3 of study area | 97 |
| 35. Vertical profiles of hydraulic head in recharge area and N3 of study area | 98 |
| 36. Conceptual model of groundwater flow | 99 |
| 37. Vertical profiles of NO_3^- [μ M] in recharge area and N3 | 100 |
| 38. Vertical profiles of SEC [μ S/cm] in recharge area and N3 | 101 |
| 39. Variations of hydraulic head in recharge area and N3 | 102 |
| 40a. Relationship between NO_3^- and Mn^{2+} concentrations in the silt and clay layer at N3 | 104 |
| 40b. Relationship between NO_3^- and Mn^{2+} concentrations in the silt and clay layer at N3 | 105 |
| 41a. Relationship between NO_3^- and NH_4^+ concentrations in the silt and clay layer at N3 | 106 |
| 41b. Relationship between NO_3^- and NH_4^+ concentrations in the silt and clay layer at N3 | 107 |
| 42a. Relationship between NO_3^- and SO_4^{2-} concentrations in the silt and clay layer at N3 | 108 |
| 42b. Relationship between NO_3^- and SO_4^{2-} concentrations in the silt and clay layer at N3 | 109 |
| 43a. Relationship between NO_3^- and DIC concentrations in the silt and clay layer at N3 | 110 |

43b. Relationship between NO_3^- and DIC concentrations in the silt and clay layer at N3 . . . 111

44. Attenuated NO_3^- concentrations of groundwater
in unweathered sediment of the silt and clay layer at N3 112

45. In the NO_3^- attenuation zone of interface between the loam layer and sand and gravel layer, mixing diagram for nitrate and chloride, indicating between groundwater in the loam layer, that in the sand and gravel layer and that in the deeper silt and clay layer during three distinct periods. 116

46. Locations of piezometers used in Figure 45 117

47. Locations of piezometers used by Figures 48 and 49 118

48. Relationship between Mn^{2+} concentrations and gradient of water table
in the loam layer at N2 to FN. 119

49. Relationship between total SO_4^{2-} concentrations and gradient of water table
in the loam layer at N2 to FN. 120

50. Relationship between total NO_3^- and NH_4^+ concentrations loam layer at N2 to FN 121

51. Conceptual model on formation of nitrate attenuation zone in interface
between the loam layer and the sand and gravel layer 122