Survey of Water Quality and Clogged Groundwater-drainage-pipe Condition of Landslide Mitigation Works

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INTRODUCTION

Degradation of the performance of groundwater drainage works (e.g., horizontal drainage boring works) due to clogging at landslide sites are reported[1)]. We introduce a method for simple evaluation of clogging caused by iron bacteria by on-site measurement of water quality such as Oxidation-Reduction-Potential (ORP) and hydrogen-ion concentration (pH).

METHODS

To conduct on-site water quality survey and visual inspection of the clogged condition, 20 outlets of drainage wells or horizontal drainage borings in the following three landslide sites were selected: (1)Chausuyama (Shinonoi, Nagano city), (2)Shimoishikawa (Shinonoi, Nagano city) and (3)Shinbunichi (Odagiri, Nagano city). The visual inspection was conducted by a five-level evaluation (**Tab. 1**)[2)]. Water quality was tested using WM-32EP (DKK-TOA CORPORATION) for ORP, pH and other chemical parameters.

RESULTS

Fig. 1 shows the relationship between Clogging and Water Quality. The solid line in the **Fig. 1** shows the boundary between the stable field of ferrous iron ions and iron hydroxide. The upper part of the boundary line is the stable field of iron hydroxide, and the lower part is the stable field of ferrous iron ion. At the boundary, the activities of both chemical species are equal. The water quality of all outlets which were Clogged level 1 was in the stable field of iron hydroxide. Clogged level 1 is an outlet which no clogging material was observed at all. On the other hand, the water quality of many outlets of Clogged level 2 to 5 was in the stable field of ferrous iron ion. In addition, it was confirmed that the occlusive material observed at these outlets contained a large amount of iron compounds by X-ray diffraction analysis.

Tab. 1 Classification of clogged level[2)]

Clogged Level	Occupied ratio
1	Nothing
2	A few
3	Under 25 %
4	25-50%
5	Over 50%

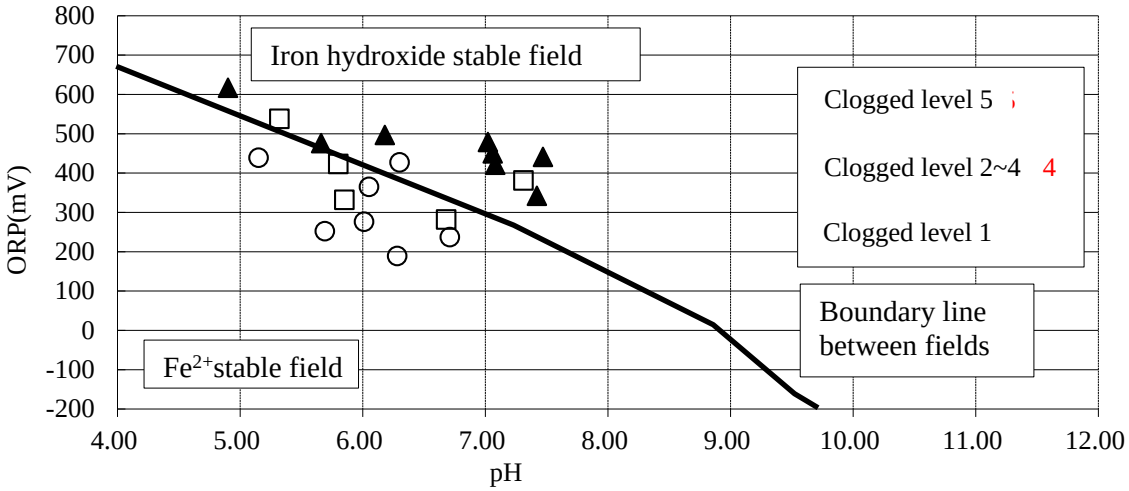

Fig. 1 Relationship between Clogging and Water Quality

From the above results, the following assumptions are possible. In the stable field of iron hydroxide having a low concentration of iron which is dissolved in groundwater as iron ions, clogging by the iron compound is unlikely to occur. On the other hand, clogging by the iron compound tends to occur in the stable field of the ferrous iron ion which can increase the iron concentration in the groundwater as iron ion. It is known that in ferrous iron ion stable field, bacteria and their products act as catalysts to efficiently produce iron compounds[3)].

CONCLUSION

In case of water quality shows stable fields of ferrous iron ion, Clogged level tends to be higher. There is some possibility to evaluate the clogging trend by on-site measurement of water quality survey such as ORP and pH.

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