

## A Comparative Study of Tracer Tests in Fractured and Porous Media (단열 및 다공질 대수층에서의 추적자 시험연구)

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### 요 약 문

To understand and compare tracer transport in fractured and porous media, multiple tracer tests were conducted in Wonju and Uiwang sites. The target media were fractured in Wonju site and porous in Uiwang site. It was known that groundwater flow for the two hydrogeologic systems could be represented using a EPM approach. However, the tracer transport in the two aquifer systems was greatly different. In this study, we analyzed the different tracer transport behavior in the two systems, from which our understanding of the tracer dispersion was greatly enhanced. We used bromide and chloride as tracers.

**Key word:** fractured and porous media, tracer test, transport, dispersivity

### 1. Introduction

Multiple tracer tests were conducted to understand and compare the tracer transport in the two different aquifer systems, i.e., fractured and porous media. Main goal of the tracer tests was to estimate transport parameter such as dispersivity. The hydrogeologic conditions of the Wonju and Uiwang test sites were well characterized by previous studies (Lee, 1998; Lee and Lee, 1999; Lee and Lee, 2000; Lee et al., 2001a,b).

### 2. Test and Materials

The Wonju test site was located at Buron-myun, southwest of Wonju city, Korea. The test site consists mainly of topographically low relief mountains and hills. The top level around the test site is Kinkyungsan (352 m). The stratigraphic units underlying the test site include a Precambrian gneiss bedrock sequence intruded by Jurassic plutonic intrusive and Cretaceous dike, which were covered by reclamation soil (Lee, 1998; Fig. 1). Natural gradient tracer tests were conducted in both the fractured zone and reclamation zone using bromide (Br).

The Uiwang site is located about 45 km southeast of Seoul, Korea. Stratigraphic units

underlying the site include Precambrian gneiss, overlying alluvial deposits, and local reclamation soil (Fig. 1). The upper part of the Precambrian gneiss is slightly weathered and lies 5~6 m below the ground surface. This is practically the bottom of the shallow aquifer in this area. The alluvial deposits are mainly composed of two layers: fine sand and gravelly coarse sand. The fine sand and gravelly coarse sand layers ranged from 0.5 to 2 m, and 2 to 6 m, respectively, with varying thickness. Surface material is an artificial reclamation soil (clayey-organic soil) or pavement. The main flow of ground water occurs in the gravelly coarse sand layer. The water table at the level of 1.5~3.5 m below ground surface fluctuates with a vertical range of approximately 2 m over the year due to precipitation events and ground water flow induced by regional recharge. The hydraulic gradient is about 0.006 with seasonal variations. The natural graident tracer testes were conducted two times using Br and Cl in September and November 1999.

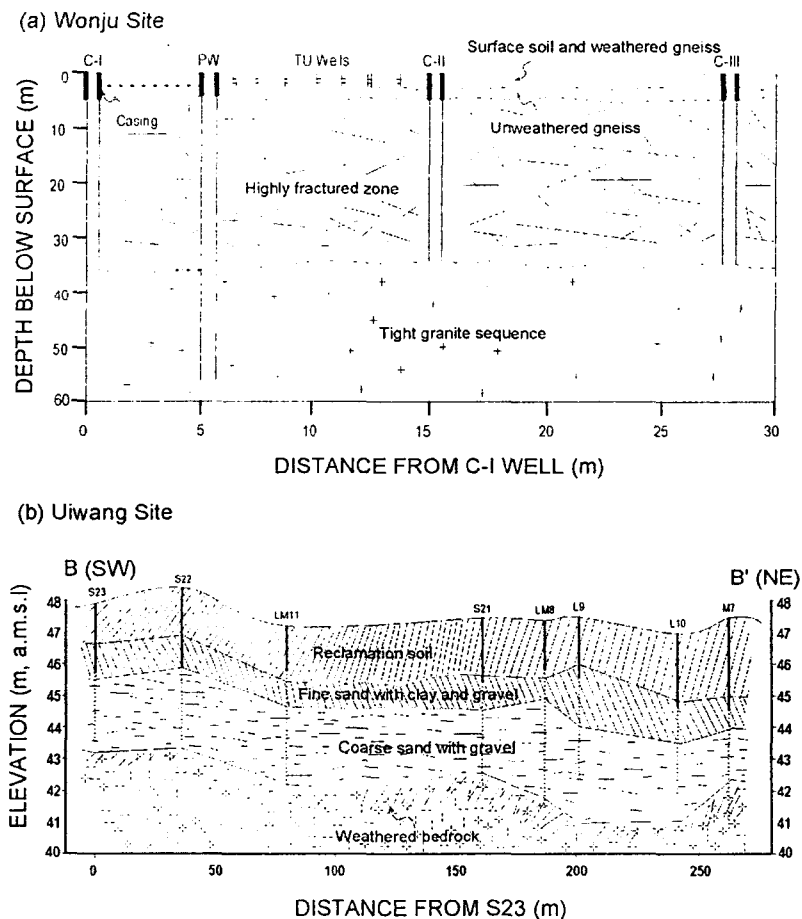


Fig. 1 Geologic sections at the two test sites.

### 3. Results

Figs. 2 and 3 shows the

results of the natural tracer tests in the Uiwang and the Wonju test sites, respectively.

#### 4. Conclusion

Based on the above results and the transport parameter estimates, it can be inferred that tracer transport in fractured media was greatly different with depth and transverse spreading would be enhanced in the low hydraulic gradient season. Transverse spreading of the contaminant plume was small in the high water season (i.e., high hydraulic

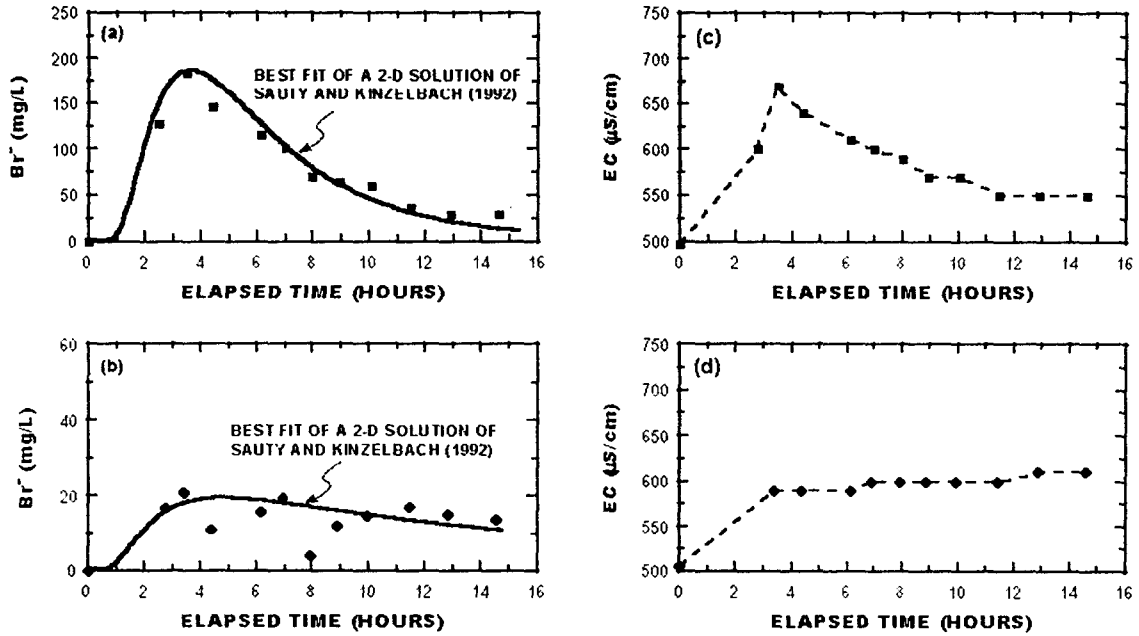


Fig. 2 Results of natural gradient tracer test in the Uiwang site (September 1999)

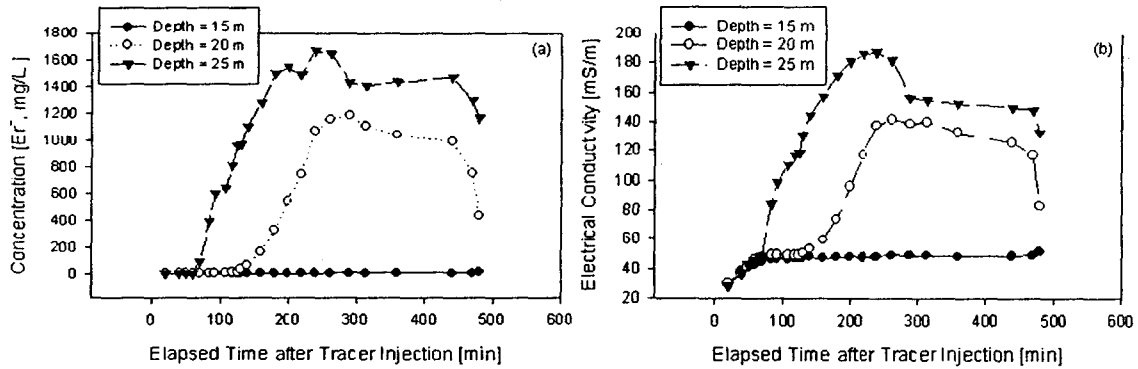


Fig. 3 Results of natural gradient tracer test in the Wonju site.

gradient season) and was relatively large in the low water season. This was contradictory to a transport theory. The different behaviors between the two tracers (bromide and chloride) deserve further study.

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