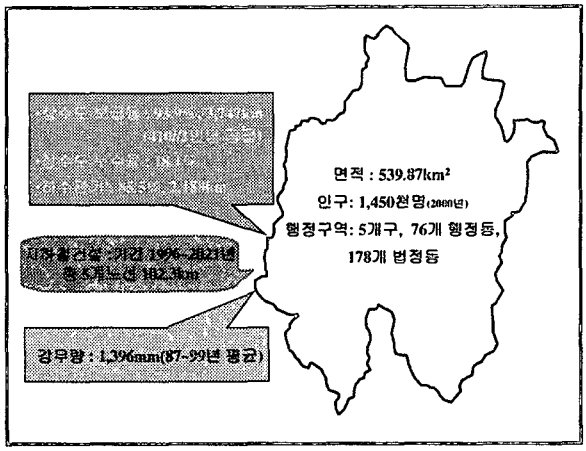
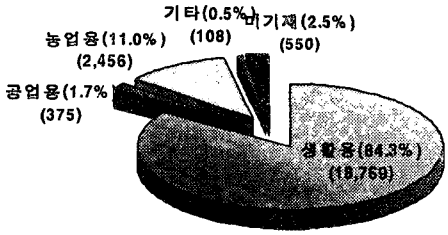
자원환경지질학회 심포지움
2004년 12월 3일 대전대학교

대도시 지하수의 수질오염특성과 관리대책
-대전광역시를 중심으로-

대전대학교 지구시스템공학과
정 찬 호
chjeong@dju.ac.kr

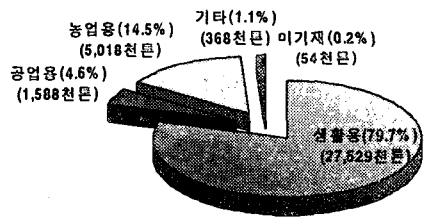


용도별 지하수 개발시설 현황



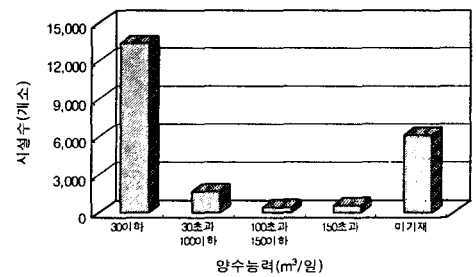
전체 : 22,258개소

용도별 지하수 이용현황

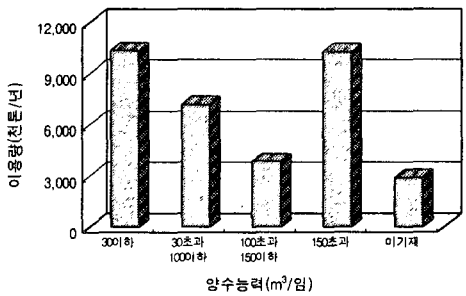


총사용량 : 34,556천톤

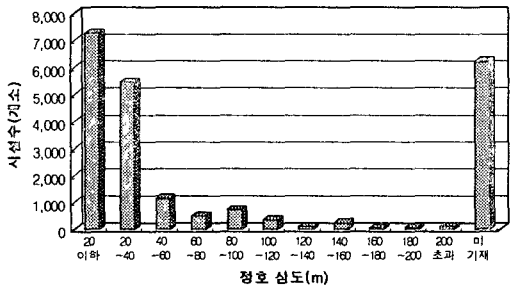
양수능력별 지하수 현황(시설수)



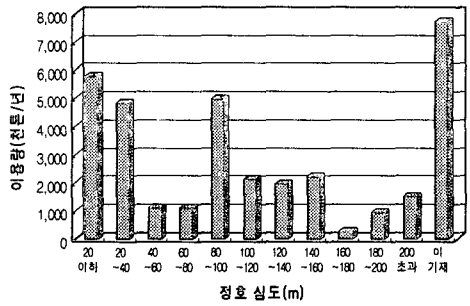
양수능력별 지하수 현황(이용량)



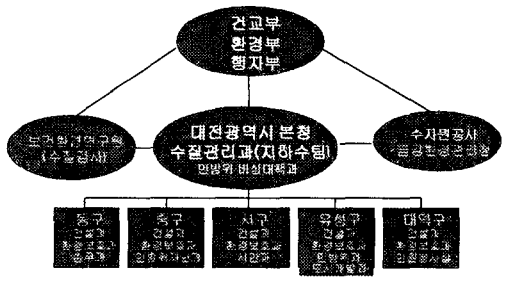
정호심도별 지하수 현황(개소수)



정호심도별 지하수 현황(이용량)



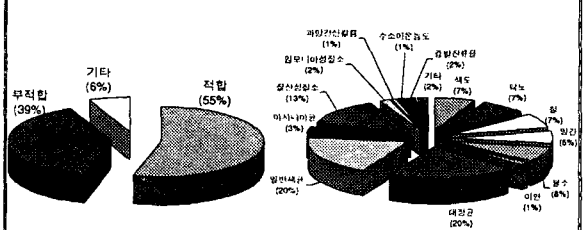
지하수 관리체계



지하수 관리

1. 시 본청 : 수질 측정망(20개지점)
2. 금강환경관리청 :
   지하수 오염우심지역(24개지점)
3. 민방위 급수시설 관리 : 225개소
4. 약수터 수질 관리 : 61개소
5. 예비정 관측정 수질관리
6. 건교부 광역 관측망 : 2개소

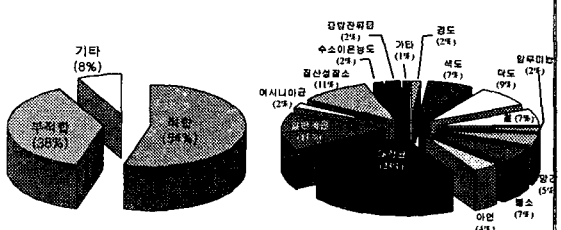
대전광역시 음용수 수질분석 현황(1999)



총의뢰건수 : 1,771건

부적합 요인

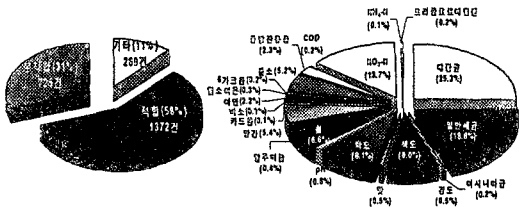
대전광역시 음용수 수질분석 현황(2000)



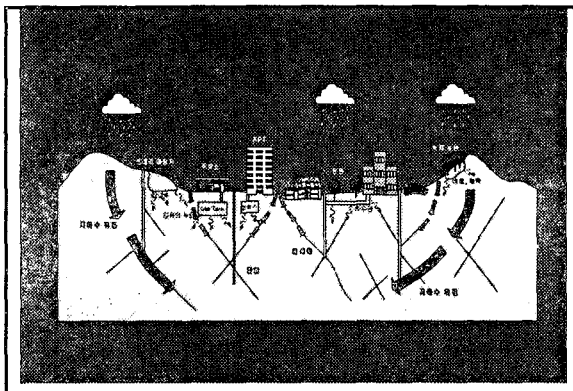
총의뢰건수 : 1,348건

부적합 요인

대전광역시 음용수 수질분석 현황(2001)

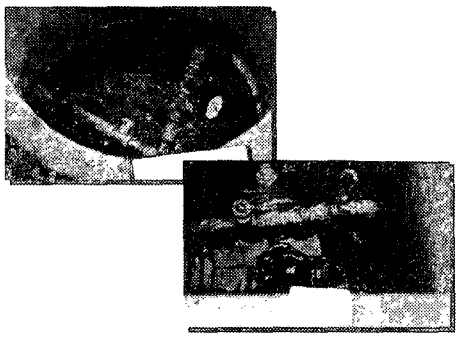


총 의뢰건수 : 2,366건

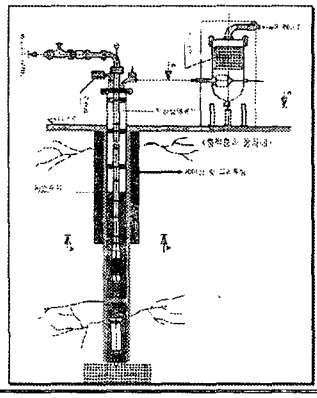


대도시 지하수 오염원

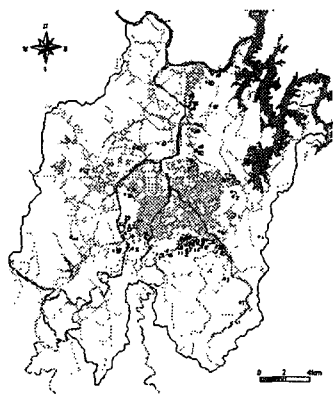
양수정 정호박스 내부



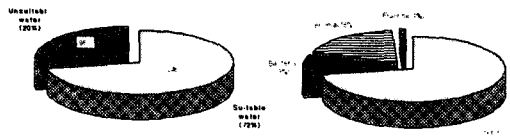
수질개선을 위한 양수정 설계도면



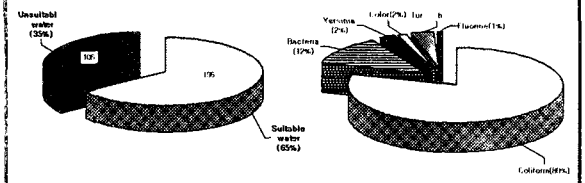
약수터 분포

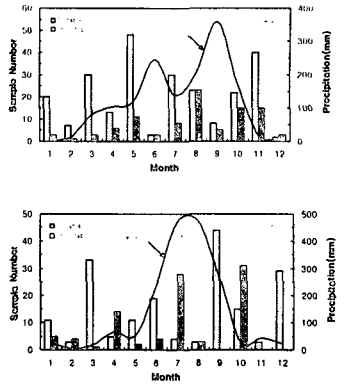


1999년



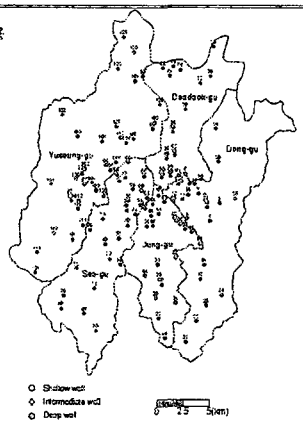
2000년





지하수의 수질화학 특성

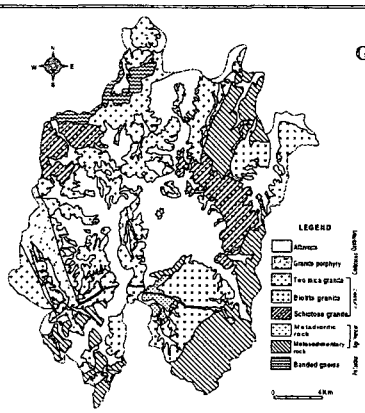
수질모니터링용
지하수공 분포

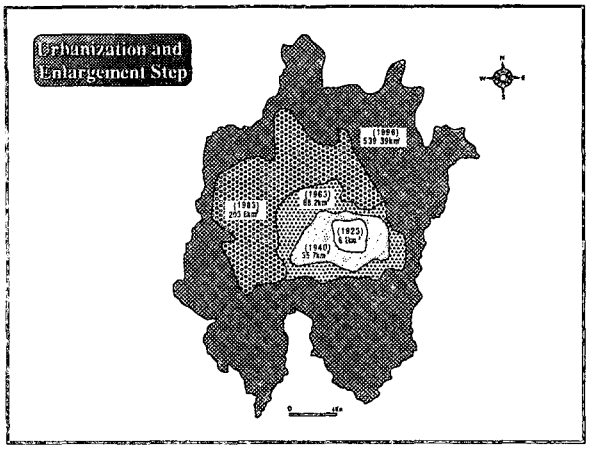


대도시 지하수의 수질화학에 영향을 미치는 요소

- 지질특성 (물-암석 반응)
- 토지이용형태
- 오염원의 분포
- 인간활동 관련 시설등 :
  지하철, 건설공사....
- 도시기반시설 (상하수도)

Geologic Map





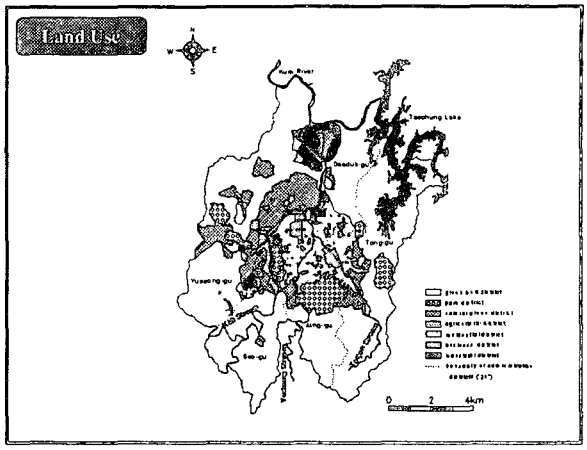
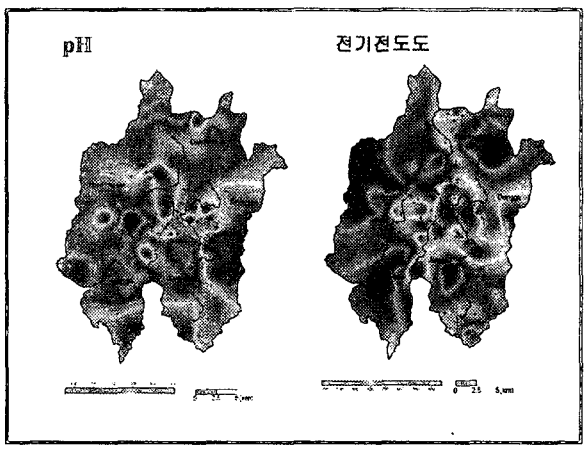
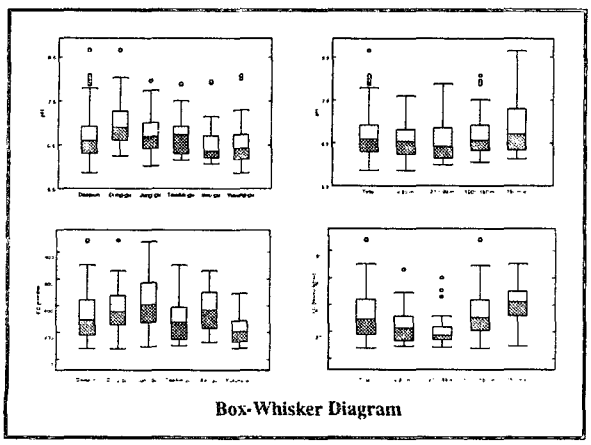


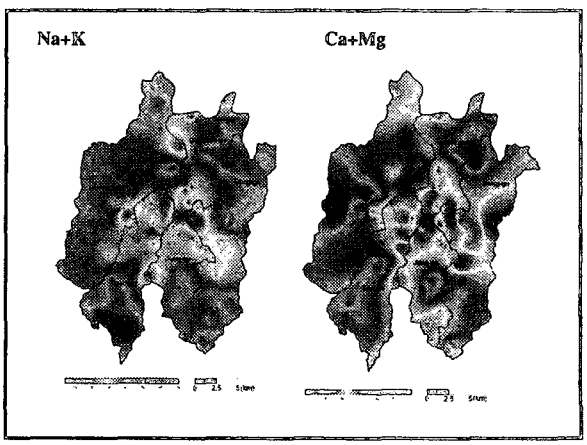
Table 1. Chemical compositions of groundwater according to land use in the Taejon area

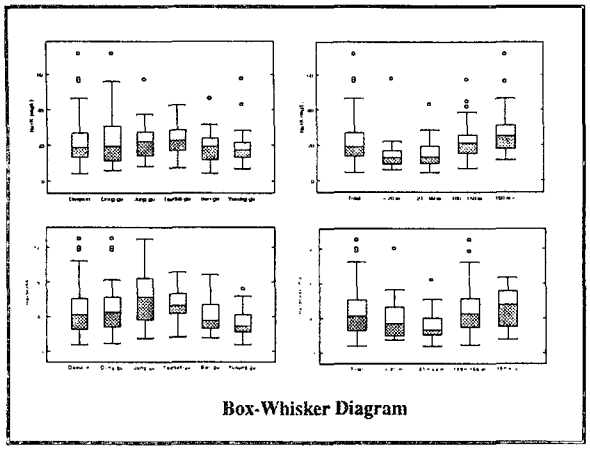
Land use		pH	EC (μS/cm)	$EpCO_2$	Na^+ (mg/l)	K^+ (mg/l)	Ca^{2+} (mg/l)	Mg^{2+} (mg/l)	HCO_3^- (mg/l)	Cl^- (mg/l)	SO_4^{2-} (mg/l)	NO_3^- (mg/l)	F (mg/l)	SiO_2 (mg/l)
Residental district (old town) (77)*	Ave	6.72	403	99.6	23.6	2.51	48.7	7.02	113	38.2	31.5	36.2	0.53	29.6
	Max	8.63	874	499	65.8	13.2	109	18.4	332	111	102	152	3.68	46.4
	Min	5.82	115	0.9	5.68	0.50	11.5	1.53	29.7	3.77	0.96	0.00	0.00	2.70
Residental district (new town) (26)*	Ave	6.57	284	64.8	19.1	1.32	32.7	4.73	74.1	30.0	17.3	31.2	0.33	32.3
	Max	7.87	1290	203	75.1	2.26	119	26.2	146	339	55.6	56.9	1.63	45.6
	Min	5.77	71.6	3.7	9.76	0.53	4.60	0.60	28.3	1.86	1.28	0.00	0.00	12.20
Business district (10)*	Ave	6.65	359	106	45.4	2.46	36.5	5.22	182	60.7	24.8	32.4	1.06	28.4
	Max	7.21	743	294	101	8.33	79.3	15.9	196	88.0	47.3	120	5.99	38.9
	Min	5.79	120	3.0	5.93	0.56	11.9	0.32	25.7	11.5	7.00	0.00	0.00	2.55
Industrial district (7)*	Ave	6.53	307	156	36.7	2.55	55.7	9.61	178	47.4	30.9	8.40	1.16	36.9
	Max	6.93	674	342	54.5	3.96	86.2	13.3	272	65.7	55.6	23.3	1.76	43.0
	Min	6.24	163	48.0	17.3	1.12	21.7	2.72	64.5	7.21	4.23	0.00	0.00	27.4
Green domain (39)*	Ave	6.66	229	69.0	14.9	1.43	26.9	3.76	78.4	17.0	12.5	15.5	0.38	26.9
	Max	8.30	666	295	45.9	3.94	74.1	15.4	227	66.7	72.9	71.4	2.23	55.9
	Min	5.96	65.4	1.8	4.13	0.32	5.81	0.73	35.2	2.37	0.45	0.52	0.00	1.85
Small residental area in green district (6)*	Ave	6.31	419	176	21.0	1.66	48.1	11.3	192	41.4	33.9	38.7	0.24	24.7
	Max	6.99	903	372	42.7	2.76	111	20.6	165	151	63.1	167	0.75	50.3
	Min	5.64	198	20.7	6.91	0.76	19.7	2.55	41.6	6.66	0.46	2.25	0.00	9.24
Geothermal water (3)*	Ave	5.15	334	3.66	55.6	0.95	39.5	9.24	140	25.9	21.4	34.8	2.65	21.4
	Max	6.54	412	5.88	83.1	1.17	80.6	8.45	157	41.7	36.9	23.4	4.75	24.2
	Min	7.92	283	0.6	44.1	0.74	12.9	0.07	109	13.4	12.2	5.42	1.34	17.5

* Green district: ex. hills, park district, natural green district and green belt district
* The number in parenthesis indicates the number of groundwater wells

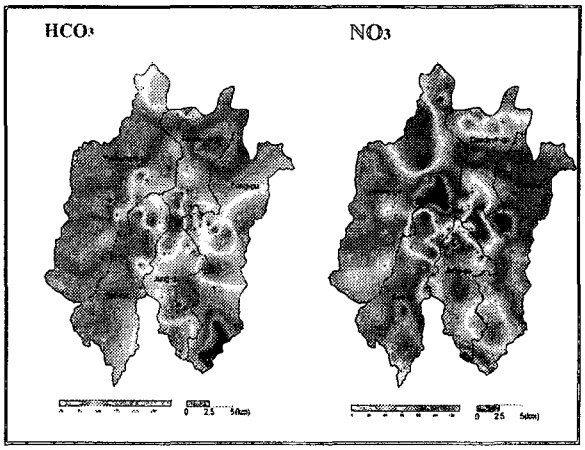


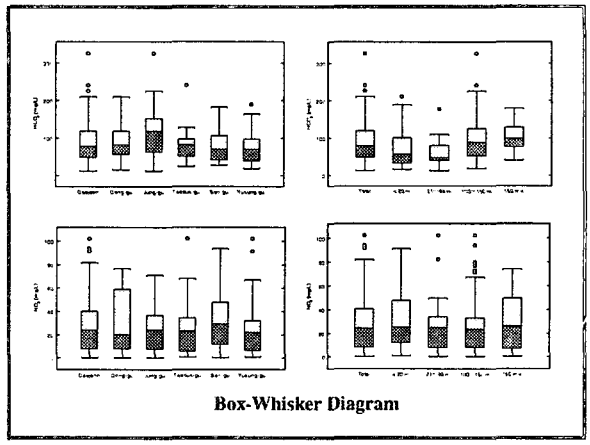




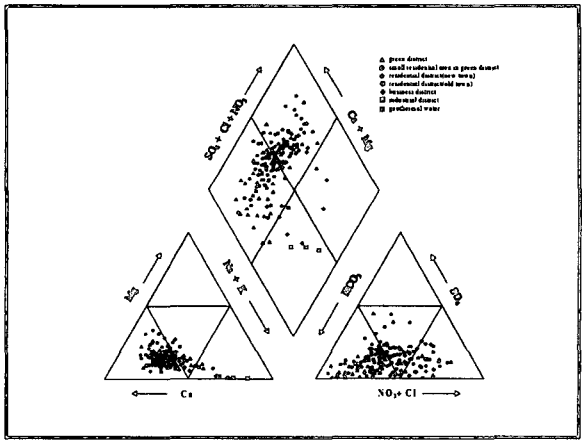


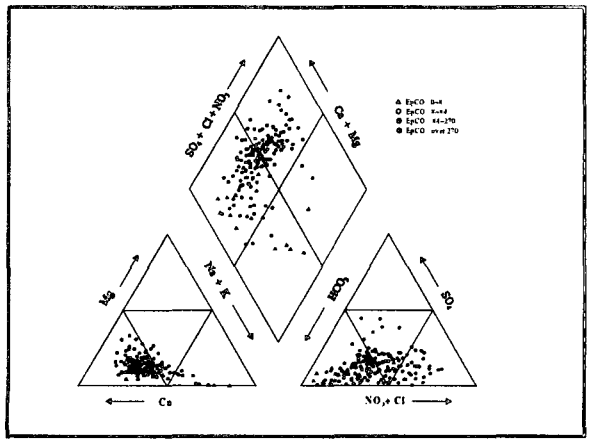
Box-Whisker Diagram

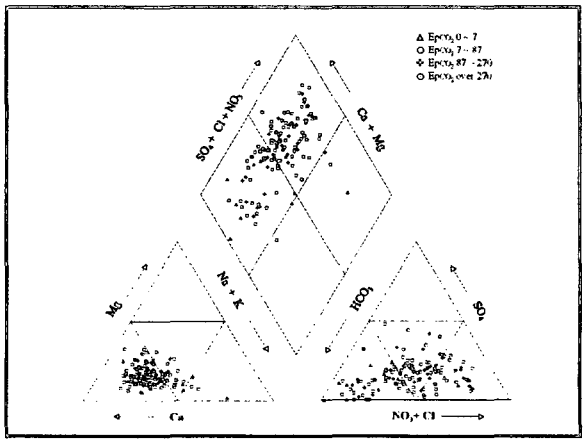




Box-Whisker Diagram







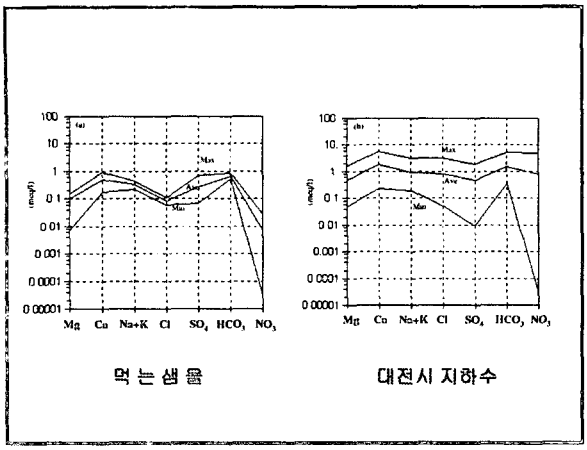


Table 4 Equamax factor matrix of chemical constitues and factor scores of groundwater samples

Variables	Factor 1	Factor 2	Factor 3	Commun
HCO_3	0.932	-0.113	0.036	0.883
Ca	0.767	0.555	-0.009	0.896
Mg	0.738	0.657	0.029	0.711
EC	0.709	0.456	0.011	0.976
SO_4	0.622	0.527	0.194	0.703
NO_3	-0.086	0.898	-0.048	0.816
Cl	0.467	0.697	-0.043	0.705
Na	0.475	0.480	0.038	0.458
SiO_2	0.226	0.237	-0.792	0.734
K	0.276	0.208	0.775	0.720
Initial Eigen	3.47	2.859	1.274	
% of Variance explained by each other	34.70	28.59	12.74	
Cumulative % of varian	34.70	63.29	76.03