Chemical and Isotopic Indicators of Groundwater Evolution in the Basal Sands of a Buried Bedrock Valley in the Midwestern United States: Implications for Recharge, Rock-Water Interactions and Mixing. [Data Repository – Tables, Figures, Discussion]

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Table DR1a. Field parameters of groundwater from the Mahomet aquifer of the MBV.

Sample ID	County	Depth (m)	Temp. (C)	pH	Eh (mv)	Sp.C.(_uS/cm)
MCVA & Confluence Region:						
Site-17A	Tazewell	46.3	14.2	6.9	59	657
Site-2	Tazewell	72.2	13.4	7.4	55	932
Site-10A	Tazewell	55.5	13.6	7.5	51	788
Site-18d	Tazewell	67.7	13.0	7.2	64	715
Site-11d	Tazewell	72.2	13.8	7.5	32	666
Site-25	Tazewell	93.6	13.9	7.5	56	859
DC-3	Tazewell	102.1	13.1	7.5	58	554
SWS-2A	Tazewell	81.4	13.4	7.4	68	955
Site-24A	Tazewell	93.6	13.9	7.3	50	667
Site-15	McLean	72.2	13.3	7.6	77	1276
Western						
Blr*	McLean	82.0	13.4	7.2	115	898
BYDN-99	McLean	85.3	13.3	7.3	51	1032
HRTLND-99	McLean	104	13.6	7.3	70	988
Flnr	DeWitt	102.1	12.4	7.6	20	961
WRD-30	DeWitt	102	13.5	7.4	39	914
WRD-26	DeWitt	77.7	13.3	7.5	41	928
WRD-25	DeWitt	83.2	13.3	7.3	53	876
WRD-23	DeWitt	78.6	12.4	7.4	78	860
RVS-99	Piatt	69.5	12.7	7.4	57	850
WESTM	Piatt	36.0	11.0	7.4	110	1037
North 1M	Piatt	59.4	11.8	7.5	68	711
Dctr 1B	Piatt	89	11.7	7.1	76	684
ISGS-1	Piatt	80.8	13.0	7.4	135	890
Thmp	Piatt	57.9	13.3	7.6	36	1297
KRK-99	Piatt	67.1	12.9	7.3	77	825
LM-2K	Piatt	65.5	13.4	7.0	99	2196
MONT-5	Piatt	84.1	13.0	7.7	-2	626
WRD-56	Piatt	63.4	13.5	7.2	80	858
Central & Eastern Region:						
E5*	Piatt	61.0	13.0	7.2	113	657
WRD-55	Piatt	72.5	13.3	7.2	80	688
CHM-96C	Champaign	88.4	13.8	7.1	76	699
CHM-98A	Champaign	74.7	17.9	7.4	51	727
CHM-95D-2	Champaign	86.3	13.4	7.6	36	641
CHM-95D	Champaign	86.3	14.0	7.4	-28	645
CHM-96B-2	Champaign	89.9	13.4	7.5	61	683
CHM-96B	Champaign	89.9	13.9	7.3	92	676
W55-98	Champaign	91.4	13.1	7.5	56	648
W58-98	Champaign	99.4	13.2	7.6	37	603
W-60*	Champaign	104	13.0	7.5	33	614
CHM-95B	Champaign	85.3	13.8	7.4	40	665
W57-98	Champaign	92.6	13.0	7.6	49	637
CHM-96A	Champaign	94.5	13.8	7.3	107	670
CHM-94A	Champaign	117	14.1	7.4	71	664
CHM-94A-2	Champaign	117	13.9	7.4	62	665
FRD-94A	Ford	114	14.2	7.5	138	749
VER-94D	Vermillion	91.4	13.6	7.3	86	644
IRO-94A	Iroquois	93.0	13.4	7.2	60	643
Northeastern Region:						
WJ-00	Ford	84.1	12.8	7.7	36	742
IRO-96A	Iroquois	62.5	12.1	7.3	76	1280
IRO-95A	Iroquois	71.6	14.3	7.3	85	959
IRO-98A	Iroquois	56.4	13.8	7.3	104	1003
TMR2*	Iroquois	64.0	11.8	7.2	-67	1247
IRO-98B	Iroquois	57.0	16.7	7.38	54	1364
VER-94A	Vermillion	77.7	14.4	7.3	87	1303
IRO-98C	Iroquois	52.4	17.2	7.49	56	673
IRO-98D	Iroquois	70.7	21.9	7.76	57	794

* sampled previously (Panno et al., 1994), Sp. Cond. calculated from ion concentration.

Table DR1b. Field parameters of groundwater from Glasford Sand aquifer over the MBV.

Sample ID	County	Well Depth (m)	Temp. (C)	pH	Eh (mV)	Sp.Cond. (uS/cm)
MCVA & Confluence Region:						
Site-17s	Tazewell	21.9	13.7	7.1	85	677
Sauder-17	Tazewell	51.8	12.1	7.5	118	605
Site-10B	Tazewell	29.0	14.7	7.6	44	613
Site-18s	Tazewell	47.9	12.7	7.1	51	717
SWS-2B	Tazewell	28.3	12.3	7.7	74	649
Site-24B	Tazewell	37.2	13	7.4	63	649
ALR*	Tazewell	37	14	7.4	na	na
Western Region:						
STBLF-99	McLean	32.0	13.7	7.2	90	733
WLspr	DeWitt	spring	12.4	7.3	101	606
ARN-99	DeWitt	18.6	13.8	7.2	91	645
GDg	Piatt	12.2	10.6	7.7	179	656
WESTG	Piatt	20.4	12.2	6.9	142	998
NRTHG	Piatt	20.4	12.6	7.1	119	888
DCTR1A	Piatt	30.5	11.3	7.7	54	687
BART-99	Piatt	27.1	13.1	7.0	101	723
Central & Eastern Region:						
E7*	Piatt	21	13.5	7	113	665
E8*	Piatt	4.3	13	7.3	428	902
STAF-99	Champaign	34.7	14.2	7.3	72	606
ISAC-99	Champaign	15.8	14.1	7.4	35	628
W43*	Champaign	66.0	13	7.5	33	624
SG	Champaign	40.2	13	7.2	88	670
BRND-99	Ford	38.1	12.9	7.5	41	591
CHM-94B	Champaign	81.0	13.7	7.2	103	720
TM-00	Ford	69.5	12.7	7.6	7	677
UD*	Ford	26.2	12.7	7.4	350	505
FRD-94B	Ford	61.0	15.4	7.3	106	617
IRO-94B	Iroquois	61.0	13.0	7.3	49	694
HPS*	Vermillion	29.87	14.2	7.45	55	685
Northeastern Region:						
TMR1*	Iroquois	24.4	11.8	7.1	-52	1301
VER-94b	Vermillion	41.1	13.7	7.1	214	2000

* sampled previously (Panno et al., 1994), Sp. Cond. calculated from anion concentration

Table DR2a. Results of chemical analyses of groundwater from the Mahomet aquifer of the MBV.

Sample ID	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	SiO_2 (mg/L)	HCO_3 (mg/L)	NO_3 (mg/L)	NH_3 (mg/L)	SO_4 (mg/L)	Cl (mg/L)	Fe (mg/L)	Mn (mg/L)	Ba (mg/L)	Sr (mg/L)	B (mg/L)	NVOC (mg/L)	CH_4 mol/L
Confluence Area:																	
Site-17A*	75.6	34	14.2	1.2	23.7	450	<0.08	na	<0.9	3.4	3.69	0.057	0.124	0.28	<0.02	1.85	9.1E-04
Site-2*	70.4	36.8	79.2	3.5	22.5	562	<0.08	4.5	0.9	50.1	3.07	0.126	0.225	0.60	na	7.5	2.6E-03
Site-10A*	72.1	35.4	54.4	1.5	19.5	505	<0.08	2.9	<0.9	11.6	1.84	0.150	0.236	0.47	na	4	1.9E-03
Site-18d*	80.9	38.6	10.8	1.5	21.6	501	<0.08	5	<0.9	1.8	2.66	0.040	0.095	0.32	na	6.6	3.0E-04
Site-11d*	68.1	34.9	25.0	2.2	18.1	459	<0.08	2.3	1.2	4.85	1.73	0.090	0.201	0.44	na	2.3	7.7E-04
Site-25*	75.2	36.5	67.1	2.3	19.5	555	<0.08	4.2	<0.9	31.5	2.23	0.230	0.299	0.54	na	9.7	2.7E-03
DC-3	67.5	28.6	3.7	0.5	33.4	344	<0.08	na	16.2	1.58	1.39	0.130	0.050	0.10	na	na	nd
SWS-2A*	72.8	34.3	88.2	2.2	19.7	576	<0.08	4.05	<0.9	12.9	2.55	0.065	0.490	0.60	na	5.1	3.0E-03
Site-24A*	69.1	33.3	17.9	1.5	18.4	445	<0.08	2.9	<0.9	1.1	4.64	0.040	0.147	0.59	na	7.05	7.0E-04
Site-15*	75.5	39.3	98.9	2.4	19.3	604	85.47	23.6	1.7	65.5	1.52	0.167	0.266	0.71	na	19.9	3.7E-03
mean	*72.7*	*35.2*	*45.9*	*1.9*	*21.6*	*500*		*6.18*	*5.0*	*18.4*	*2.53*	*0.110*	*0.231*	*0.46*		*7.1*	*1.8E-03*
Western Region:																	
BLr^	76.8	31.4	94.3	2.3	17.7	548	<1.9	na	0.16	55.8	2.42	0.06	0.64	0.59	0.25	na	2.5E-03
BYDN-99	74.1	37.4	117	<1	14.9	570	2.0	3.81	<0.6	72.2	2.04	0.04	0.56	0.76	0.39	8.7	3.0E-03
HRTLND-99	86.8	40.8	84	<1	15.3	586	9.8	4.95	<0.6	37.4	3.47	0.02	0.41	0.81	0.37	8.6	3.9E-03
FLNR	60.7	33.3	122	0.5	14.2	509	0.31	na	0.005	72.4	1.69	0.02	0.55	0.64	0.63	na	2.0E-03
WRD-30	64.5	33.7	101	<1	13.9	511	<1.9	2.77	<1.2	55.1	1.95	0.01	0.43	0.37	0.48	9.2	2.4E-03
WRD-26	59.6	37.2	99.9	<1	12.3	528	<1.9	2.95	<1.2	50.8	1.87	0.01	0.32	0.54	0.52	7.6	2.6E-03
WRD-25	76.6	40.7	75.7	<1	15.9	559	<1.9	2.35	<1.2	31.9	1.94	0.02	0.27	0.58	0.41	5.7	1.7E-03
WRD-23	60.9	38.2	86.4	<1	15.6	532	<1.9	3.41	<1.2	33.6	1.57	0.01	0.25	0.65	0.48	5.1	1.8E-03
REEVES-99	105	42.2	42.0	3	18.1	634	<0.04	na	<0.1	2.6	1.99	0.02	0.31	0.43	0.39	6.5	1.2E-03
WEST M	43.9	30.4	126.7	---	14.0	417	<0.06	2.20	8.7	117.9	0.82	0.06	0.36	0.82	0.37	2.2	1.3E-04
NRTH M	70.8	33.3	43.1	---	15.4	452	<0.26	1.69	2.4	7.31	2.51	0.08	0.20	0.48	0.42	2.8	3.7E-04
DCTR 1B	53.3	24.7	35.6	---	17.0	409	<0.26	6.32	<0.28	12.7	7.5	0.04	0.19	0.38	0.32	4.5	7.6E-04
ISGS 1**	32.6	13.0	159.5	---	10.7	474	<0.26	0.74	64.5	13.9	0.15	0.20	0.12	0.30	0.55	2.7	3.7E-04
Thmpsn-2K	58.6	24.9	220	2	11.6	436	<0.02	1.65	<0.1	237	2.00	0.03	0.28	0.64	0.49	8	3.7E-03
KRK-99	73.1	39.1	67.5	<1	19.5	574	<1.9	3.86	<1.2	17.8	2.40	0.01	0.53	0.59	0.24	6.0	2.8E-03
LAMB-2K	96.2	38.1	308	<1	14.3	472	<0.02	3.08	<0.1	474	3.52	0.08	0.49	0.66	0.23	6.8	3.8E-03
MONT-5	67.2	32.5	39.9	2	11.8	481	<0.04	na	0.95	4.0	2.51	0.07	0.22	0.33	0.49	3.2	2.0E-04
WRD-56	72.4	36.6	76.4	<1	16.1	565	<1.9	4.7	<1.2	24.3	2.29	0.02	0.25	0.48	0.43	8.1	2.4E-03
mean	*68.5*	*33.8*	*105.5*		*14.9*	*504*		*3.18*		*73.4*	*2.37*	*0.044*	*0.355*	*0.56*	*0.41*	*6.0*	*2.0E-03*
Central & Eastern Region:																	
E5^	80.5	30.4	24.9	1.8	22.7	442	0.06	na	13.6	2.38	1.27	0.03	0.12	0.41	0.20	na	1.1E-05
WRD-55	90.1	33.9	27.4	<1	19.1	443	<1.9	0.98	33.1	7.4	1.89	0.03	0.08	0.36	0.40	2.3	nd
CHM-96C	88.4	34.7	26.9	<1	22.7	454	<1.6	na	31.4	1.0	1.73	0.13	0.08	0.43	0.31	2.2	5.2E-06
CHM-98A	44.0	21.2	93.5	2.5	15.1	433	<0.07	2.01	1.15	25.2	2.04	0.32	0.197	0.31	0.54	7.3	na
CHM-95D-2A&B	68.2	33.7	35.3	<1	16.8	498	<1.7	1.13	<0.1	7.4	1.93	0.02	0.14	0.43	0.45	2.3	2.6E-04
CHM-95D	69.1	33.9	35.9	2	16.9	454	<1.6	na	<0.3	1.7	1.87	0.03	0.14	0.43	0.43	2.2	2.8E-04
CHM-96B-2	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	6.7E-07
CHM-96B	84.8	33.3	29.1	2	20.5	426	<1.6	na	42.8	0.9	0.84	0.13	0.08	0.39	0.57	1.4	1.1E-06
55-98	61.3	34.5	34.4	3	14.8	439	<0.8	0.71	0.2	1.8	0.91	0.05	0.42	0.57	0.42	2.0	1.8E-04
58-98	52.2	29.9	39.4	<1	13.3	408	0.04	1.34	0.2	2.1	1.11	0.02	0.35	0.53	0.70	2.7	3.4E-04
W-60^	51.0	35.0	37.0	3	16.3	421	<0.01	na	0.04	2.3	1.3	0.04	0.34	0.57	0.48	na	3.4E-04
CHM-95B	71.2	36.1	36.1	2	18.5	462	<1.6	na	6.0	1.0	0.89	0.05	0.22	0.50	0.48	2.0	3.0E-05
57-98	52.0	29.9	47.3	<1	13.5	434	<0.8	1.53	<0.3	1.5	1.31	0.02	0.33	0.58	0.98	3.5	4.9E-04

Sample ID	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	SiO_2 (mg/L)	HCO_3 (mg/L)	NO_3 (mg/L)	NH_3 (mg/L)	SO_4 (mg/L)	Cl (mg/L)	Fe (mg/L)	Mn (mg/L)	Ba (mg/L)	Sr (mg/L)	B (mg/L)	NVOC (mg/L)	CH_4 mol/L
CHM-96A	82.8	31.6	32.8	1	19.8	417	<1.6	na	42.9	0.6	0.68	0.24	0.04	0.49	0.82	2.4	1.2E-06
CHM-94A	72.6	28.3	48.9	2	19.1	456	<1.6	na	8.7	0.8	1.43	0.07	0.12	0.69	1.36	2.1	4.6E-06
CHM-94A-2	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	2.1	5.4E-06
FRD-94A	79	43.3	32.3	3	18.9	421	2.0	na	88	7.9	0.27	0.57	0.05	0.90	0.70	0.6	nd
VER-94D	60.8	30.9	35.1	<1	14.6	435	<1.9	0.71	20.0	7.2	0.99	0.12	0.25	0.99	0.61	0.8	nd
IRO-94A	71.4	29.0	44.6	2	16.8	422	<1.7	1.04	28.8	6.6	1.18	0.22	0.12	1.10	0.93	1.4	nd
mean	*69.4*	*32.3*	*38.9*	*2.2*	*17.6*	*439*		*1.18*	*22.6*	*4.6*	*1.27*	*0.123*	*0.181*	*0.569*	*0.610*	*2.3*	*1.4E-06*
Northeastern Region:																	
WJ-00	76.2	38.3	54.3	<1	14.3	481	<0.01	2.43	15	4.9	0.77	0.02	0.13	0.81	0.16	4.0	5.8E-04
IRO-96A	163	60.7	70.0	<1	16.9	392	<1.7	1.04	406	9.8	2.16	0.22	0.02	1.11	1.07	1.9	Nd
IRO-95A	118	48.1	52.7	3	19.5	546	<1.7	2.13	136	8.2	1.13	0.08	0.04	0.80	0.70	1.8	Nd
IRO-98A	111	44.0	57.9	<1.36	20.8	423	<0.07	1.66	180	3.85	1.3	0.09	0.04	1.42	1.09	3.31	Na
TMR2^	155	58.0	74.0	3.2	20.0	365	0.06	na	416	9.3	2.45	0.07	0.03	na	0.71	na	Nd
IRO-98B	162	65.0	77.3	1.59	18.0	362	<0.07	1.68	461	11.6	2.01	0.24	0.05	0.97	0.96	4.61	Na
VER-94A	151	58.9	71.8	3	16.5	381	<1.7	0.02	420	12.0	1.25	0.16	0.04	0.86	0.76	1.3	Nd
IRO-98C	75.9	29.2	45.6	2.09	17.7	427	<0.07	1.45	3.98	8.6	1.28	0.044	0.11	0.39	0.25	6.98	Na
IRO-98D	76.5	33.6	64.4	5.03	13.1	448	<0.07	2.21	65.7	8.22	0.581	0.261	0.22	0.77	0.33	5.42	Na
mean	*121*	*48.4*	*63.1*	*3.0*	*17.4*	*425*		*1.49*	*234*	*8.5*	*1.44*	*0.132*	*0.076*	*0.89*	*0.67*	*3.7*	

na - not analyzed, nd - not detected, --- - analytical problem, * elemental and NOVC data from Holm, (1995), **suspected contamination from bentonite seal (note high Na & SO_4), not include in figure 5, ^ Panno et al., 1994.

Table DR2b. Chemical analyses of groundwater sampled from Glasford Sand and Wedron aquifers over MBV.

Sample ID	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	SiO_2 (mg/L)	HCO_3 (mg/L)	NO_3 (mg/L)	NH_3 (mg/L)	SO_4 (mg/L)	Cl (mg/L)	Fe (mg/L)	Mn (mg/L)	Ba (mg/L)	Sr (mg/L)	B (mg/L)	NVOC (mg/L)	CH_4 mol/L
Confluence Region:																	
Site-17s*	81.4	35.7	6.3	0.4	15.2	361	<0.08	na	63.9	3	1.16	0.117	0.051	0.112	na	0.5	Nd
Sauder-17	81.8	32	10.9	2.0	22.2	421	0.11	na	8.3	8.3	0.81	0.040	0.070	0.150	<0.02	na	----
Site-10B*	67	37.2	13.7	0.5	16.9	421	<0.08	0.7	<0.9	2.5	1.41	0.040	0.069	0.201	na	na	1.4E-04
Site-18s*	80.9	38.6	10	1.9	14.4	488	0.088	3.6	1.1	1.8	2.98	0.060	0.088	0.284	na	4.6	2.7E-04
SWS-2B*	68.3	37.3	24.3	2.0	15.4	456	0.08	na	0.32	0.76	2.38	0.040	0.110	0.790	0.07	na	6.7E-04
Site-24B*	69.9	33.5	17.7	1.3	18.6	455	<0.08	na	<0.9	1.1	4.49	0.058	0.144	0.610	na	7	5.9E-04
ALR^	71	36	26	3.3	18.9	451	<0.02	na	0.4	0.7	1.25	0.028	0.13	0.391	0.06	na	1.39E-03
mean	*74.3*	*35.8*	*15.6*	*1.6*	*17.4*	*436*	*0.1*	*2.2*	*14.8*	*2.5*	*2.1*	*0.055*	*0.095*	*0.363*		*4.0*	*6.1E-04*
Western Region:																	
STBLF-99	87.2	42.5	21.1	<1	18.2	519	<1.6	na	<0.6	17.0	2.24	0.05	0.17	0.45	0.11	3.4	1.1E-03
WELSPR	91.6	39.8	8.11	<1	14.7	373	0.08	0.52	62.5	15.5	2.70	0.07	0.08	0.22	0.02	0.9	nd
ARN-99	84.8	36.6	8.3	<1	16.0	428	<1.6	1.69	11.7	13.6	1.78	0.05	0.10	0.23	<0.02	1.9	2.5E-05
GDg	74.1	29.9	14.3	---	13.7	306	<0.26	<0.03	97.9	4.7	<0.005	0.00	0.06	0.17	0.11	2.8	nd
WEST G	103.9	44.7	52.1	---	28.1	666	<0.06	4.30	1.32	4.7	3.45	0.08	0.22	0.44	0.27	8.3	2.1E-03
NRTH G	88.3	44.6	55.5	---	24.9	592	<0.26	3.75	1.13	2.5	3.87	0.08	0.20	0.46	0.63	6.9	2.4E-03
DCTR 1A	53.6	31.0	44.2	---	13.6	442	<0.26	1.17	<0.28	8.4	1.58	0.01	0.31	0.34	0.47	3.0	3.8E-04
BART-99	82.6	37.3	22.0	3	21.8	490	<1.6	na	2.7	7.4	3.25	0.03	0.13	0.29	0.16	5.4	9.4E-04
mean	*83.3*	*38.3*	*28.2*		*18.9*	*477*		*2.3*	*29.5*	*9.2*	*2.70*	*0.047*	*0.158*	*0.324*	*0.251*	*4.1*	*1.2E-03*
Central & Eastern Region:																	
E7^	80	32	12	2.4	24.6	464	<0.02	na	0.07	1.1	2.31	0.06	0.13	0.38	<0.02	na	7.7E-04
E8^	112	48	36	2	17.6	308	3.56	na	24	179	0.05	0.03	0.07	0.13	<0.01	na	nd
STAF-99	77.1	33.7	14.2	<1	19.2	400	<1.2	0.81	25.3	7.2	1.01	0.09	0.06	0.45	0.14	2.4	nd
ISAAC-99	83.3	36.6	6	<1	16.2	328	<1.2	0.33	69	12.5	1.74	0.04	0.08	0.22	<0.02	1.1	nd
W43^	64	34	40	2	20.4	427	<0.02	na	4.22	1.44	1.74	0.02	0.13	0.45	0.07	na	1.2E-04
SG	82.3	36.6	15.8	3	22.7	480	0.35	6.02	0.34	0.55	4.32	0.03	0.09	0.82	0.19	na	6.3E-04
BRND-99	57.9	26.4	46.9	<1	18.2	420	<1.6	na	<0.6	6.7	0.42	0.14	0.06	1.07	1.31	1.9	6.0E-05
CHM-94B	85.4	34.6	45.3	<1	17.9	448	<1.7	na	51.4	6.7	1.37	0.21	0.10	0.66	1.07	1.8	nd
TM-00	68.0	40.6	43.9	2	15.1	443	<0.01	1.47	10.5	0.7	3.05	0.02	0.09	1.20	0.74	1.26	6.8E-06
Udn	64.2	31.8	2.1	<1	22.7	252	6.13	<0.01	25.7	11.4	<0.01	<0.01	0.02	0.06	<0.01	na	2.2E-06
FRD-94B	88.5	37.0	4.76	3	20.3	440	<1.7	na	<0.3	6.6	1.06	0.12	0.06	0.18	<0.01	1.1	4.3E-05
IRO-94B	79.4	31.9	49.4	3	17.3	487	<1.7	na	13.6	6.7	0.05	0.06	0.23	1.07	0.23	2.1	nd
Hpstn	75.8	43.8	21.2	2	18.2	392	0.31	1.25	44.3	10.2	1.56	0.05	0.08	0.99	0.30	na	4.2E-05
mean	*78.3*	*35.9*	*26.0*	*2.4*	*19.3*	*406.8*	*2.6*	*2.0*	*24.4*	*19.3*	*1.56*	*0.07*	*0.09*	*0.59*	*0.56*	*1.7*	*2.1E-04*
Northeastern Region:																	
TMR1^	154	57	71	2.5	20.7	351	0.05	na	461	8.2	2.49	0.06	0.02	1.27	0.70	na	6.1E-07
VER-94b	279	96.7	104	4	20.1	301	<1.7	na	981	8.5	0.27	1.20	0.02	2.92	1.74	0.8	nd
mean	*217*	*78.1*	*87.6*	*3.4*	*20.0*	*326*			*721*	*8.3*	*1.38*	*0.63*	*0.02*	*2.09*	*1.26*		

na - not analyzed, nd - not detected, --- - analytical problem *elemental and NOVC analyses from Holm, 1995. ^ Panno et al., 1994.

Table DR3a. Results of isotopic analyses of groundwater from Mahomet Aquifer of the MBV.

Sample ID	δD (‰)	$\delta^{18}O$ (‰)	$\delta^{13}C_{DIC}$ (‰)	$\delta^{13}C_{CH4}$ (‰)	δD_{CH4} (‰)	Tritium (TU)	$^{14}C_{DIC}$ (pMC)	$\delta^{34}S$ (‰)	Calcite SI	Dolomite SI
MCVA & Confluence Region:										
Site-17A	-43.0	-6.78	-3.9	-77.9	-224	<0.38	51.7		-0.218	-0.588
Site-2	-45.0	-6.99	-2.4	-79.0	-230	<0.46	11.8		0.333	0.534
Site-10A	-43.3	-6.46	-4.0	-79.0	-220	<0.23	23.3		0.359	0.594
Site-18d	-46.2	-6.88	-5.7	-70.8	-211	<0.53	50.3		0.098	0.049
Site-11d	-44.2	-7.04	-4.1	-79.3	-221	<0.5	38.6		0.374	0.646
Site-25	-42.5	-7.01	-1.6	-79.5	-223	<0.61	18.2		0.437	0.750
DC-3	-49.6	-7.17	-9.6			<0.32	75.0		0.213	0.231
SWS-2A	-46.9	-7.00	-3.8	-80.5	-219	<0.63	7.5		0.331	0.517
Site-24A	-44.5	-7.10	-1.9			<0.42	40.9		0.134	0.141
Site-15	-50.3	-7.98	-3.2	-78.4	-230	<0.46	7.3		0.541	0.980
mean	*-45.5*	*-7.04*	*-4.0*	*-78.1*	*-222*		*32.4*			
stddev	*2.5*	*0.37*	*2.2*	*2.8*	*6*		*21.4*			
Western MA Region:										
BLR	-47.9	-7.30	-6.6	na	na	na	9.3	na	0.132	0.242
BYDN-99	-51.3	-7.40	-3.6	-81.1	-230	na*	4.5	na	0.223	0.328
HRTLND-99	-45.9	-6.98	-1.3	-81.1	-230	na	7.6	na	0.312	0.481
FLNR	-48.6	-7.30	-4.9	-78.4	-227	<0.39	5.8		0.355	0.614
WRD-30	-47.7	-7.09	-6.7	-82.7	-233	na	7.9	na	0.233	0.367
WRD-26	-48.0	-6.85	-5.5	-81.7	-224	na	15.7	na	0.307	0.590
WRD-25	-46.9	-6.64	-5.7	-81.1	-228	na	14.3	na	0.237	0.379
WRD-23	-45.8	-7.06	-5.0	-79.0	-225	na	13.8	na	0.210	0.382
REEVES99	-43.6	-6.74	-3.6	-75.1	-220	na	23.8	na	0.506	0.785
WESTM	-43.3	-6.88	-15.9			0.62	11.8		-0.032	-0.085
NORTHM	-40.6	-6.69	-12.0			<0.5	33.5		-0.085	-0.035
DCTR1B	-41.5	-6.80	-7.0	-78.9	-179	0.73	31.7		-0.216	-0.615
ISGS1	-41.5	-6.70	-11.7			<0.5	25.3		-0.072	-0.369
Thmpsn-2K	-47.0	-7.10	-8.2	-85.7	-226	<0.58	1.8	na	0.327	0.464
KRK-99	-43.5	-6.27	-1.9	-78.2	-223	na	25.6	na	0.226	0.352
LAMB-2K	-51.3	-7.46	-4.1	-82.2	-229	<0.89	4.0	na	-0.096	-0.410
MONT-5	-44.4	-6.46	-12.7	-84.4	-197	<0.29	28.0	na	0.531	0.922
WRD-56	-46.1	-6.70	-3.6	-79.5	-213	na	16.1	na	0.125	0.136
mean	*-45.8*	*-6.91*	*-6.7*	*-80.6*	*-220*		*15.6*			
stddev	*3.0*	*0.32*	*3.9*	*2.6*	*14*		*9.8*			
Central & Eastern MA Region:										
E5	-44.2	-6.75	-11.4	na	na	na	35.6		0.078	-0.092
WRD-55	-44.9	-6.87	-10.6	na	na	na	33.5	9.3	0.117	-0.010
CHM-96C	-44.7	-6.94	-10.6	na	na	na	na	na	0.028	-0.161
CHM-98A	-44.3	-6.93	-14.2			<0.66	6.5	na	0.128	0.194
CHM-95D-2	-40.4	-6.32	-11.8	-83.6	-205	na	28.5	na		
CHM-95D	-41.4	-6.55	-11.8	na	na	na	na	na	0.460	0.795
CHM-96B-2	-42.3	-6.64	-11.8	na	na	na	33.0	3.2		
CHM-96B	-43.8	-6.86	-11.5	na	na	na	na	na	0.184	0.153
55-98	-44.5	-6.36	-12.5	na	na	<0.42	na	na	0.265	0.457
W-58-2/10/00	na	na	-11.2	na	na	na	na	na	0.275	0.486
W-60**	-44.7	-6.84	-11.6	-77.8	-217	<0.3	33.1	na	0.171	0.354
CHM-95B	-41.7	-6.56	-14.9	na	na	na	na	na	0.253	0.400
57-98	-44.2	-6.43	-9.9	na	na	<0.52	23.6	na	0.292	0.519
CHM-96A	-40.8	-6.54	-11.4	na	na	<0.66	na	na	0.165	0.101
CHM-94A	-44.6	-6.70	-15.0	na	na	<0.40	na	na	0.262	0.309
CHM-94A-2	-41.3	-6.57	-15.0	na	na	na	22.6	na		
FRD-94A	-44.9	-6.72	-11.5	na	na	<0.62	35.6	1.6	0.330	0.594
VER-94D	na	-6.57	-11.9	na	na	<0.44	36.2	13.4	0.062	0.014
IRO-94A	-42.8	-6.71	-12.7	na	na	<0.53	33.4	15.4	0.009	-0.193

mean	*-43.3*	*-6.66*	*-12.2*	*-80.7*	*-211*		*29.2*	*8.6*		
stddev	*13.4*	*1.50*	*1.5*	*2.9*	*6*		*8.5*	*5.4*		
Northeastern MA Region:										
WJ-00	-57.1	-8.32	-13.5	-86.5	-239	<0.34	1.9	15.5	0.568	1.009
IRO-96A	-42.1	-6.50	-16.7	na	na	<0.42	8.5	-0.8	0.273	0.282
IRO-95A	-43.9	-6.73	-15.8	na	na	<0.45	18.5	3.1	0.378	0.564
IRO-98A	-46.9	-6.91	-13.0	na	na	<0.78	25.7	-1.2	0.194	0.176
TMR2	-47.0	-7.12	-15.8	na	na	na	13.4	-1.1	0.118	-0.032
IRO-98B	-45.3	-7.03	-16.4	na	na		7.2	1.2	0.370	0.581
VER-94A	-41.9	-6.73	-17.8	na	na	<0.58	12.9	-1.6	0.261	0.314
IRO-98C	-46.9	-7.32	-16.8	na	na	<0.89	8.0	57.1	0.388	0.606
IRO-98D	-48.0	-7.19	-15.5	na	na		9.2	25.7	0.710	1.376
Mean	*-46.6*	*-7.09*	*-15.7*				*11.7*	*10.9*		
stddev	*4.3*	*0.50*	*1.5*				*6.6*	*18.6*		

* na - not analyzed, ---- sample lost during preparation

Table DR3b. Isotopic analyses of groundwater from the Glasford Sand and Wedron aquifers of the MBV.

Sample ID	δD (‰)	$\delta^{18}O$ (‰)	$\delta^{13}C_{DIC}$ (‰)	$\delta^{13}C_{CH4}$ (‰)	$\delta^{13}C_{CH4}$ (‰)	Tritium (TU)	$^{14}C_{DIC}$ (pMC)	$\delta^{34}S$ (‰)	Calcite SI	Dolomite SI
MCVA & Confluence Region:										
Site-17s	-44.8	-7.18	-8.4			24.93	69.9		-0.065	-0.300
Sauder-17	-49.8	-7.41	-9.9			<0.38	63.0		0.352	0.453
Site-10B	-42.8	-6.82	-13.7	-72.7	-138	<0.25	69.9		0.408	0.765
Site-18s	-41.7	-6.87	-6.0	-72.5	-214	<0.40	51.2		-0.086	-0.324
SWS-2B	-43.7	-6.94	-1.3			<0.38	38.2		0.507	0.915
Site-24B	-44.0	-7.17	-1.3	-78.4	-239	na	40.7		0.234	0.322
ALR	-45.5	-6.94	-3.3	-80.2	-232	<0.25	34.2		0.249	0.395
Mean	*-44.6*	*-7.05*	*-6.3*	*-76.0*	*-206*		*52.4*		*0.228*	*0.318*
Stddev	*2.4*	*0.20*	*4.3*	*3.4*	*40*		*14.1*		*0.228*	*0.479*
Western Region:										
STBLF-99	-44.6	-6.72	-2.7	-81.2	-239	<0.52	38.8	na	0.177	0.227
WELSPR	-42.5	-6.82	-8.2	na	na	14.10	61.7	na	0.129	0.062
ARN-99	-47.9	-7.04	-8.5	na	na	4.03	58.7	29.2	0.095	0.014
GDg	-42.9	-6.27	-13.8			6.28	91.1		0.330	0.401
WESTG			0.6			1.02	20.3		0.014	-0.178
NRTHG	-40.7	-6.62	0.7			<0.5	16.8		0.109	0.088
DCTR1A	-43.7	-6.89	-12.4	-81.0		<0.66	30.4		0.381	0.669
BART-99	-44.4	-6.82	0.0	-74.5	-227	0.82	33.4	na	-0.073	-0.316
Mean	*-43.8*	*-6.74*	*-5.5*	*-78.9*	*-233*	*5.25*	*43.9*		*0.145*	*0.121*
Stddev	*2.1*	*0.23*	*5.5*	*3.1*	*6*	*4.87*	*23.4*		*0.151*	*0.313*
Central & Eastern Region:										
E7	-47.2	-7.33	-4.6	na	na	<0.32	52.7	na	-0.091	-0.427
E8	-48.2	-7.27	-10.7	na	na	na	90.2	na	0.129	0.067
STAF-99	-46.3	-6.94	-6.9	na	na	0.73	57.8	17.8	0.134	0.103
ISAC-99	-45.6	-6.99	-7.4	na	na	7.66	64.8	1.5	0.168	0.174
W43	-42.1	-6.91	-12.4	-78.8	-210	<0.3	28.3		0.268	0.436
SG	-45.5	-6.97	-5.8	-76.3	-234	<0.31	60.1	na	0.117	0.057
BRND-99	-43.6	-6.57	-14.7	na	na	<0.62	28.1		0.226	0.282
CHM-94B	-41.0	-6.62	-16.0	na	na	<0.79	19.8	4.3	0.097	-0.012
TM-00	-42.9	-6.51	-10.9	na	na	<0.62	44.9	14.4	0.391	0.728
UD	-48.3	-7.50	-8.2	na	na	6.97	91.4		-0.044	-0.223
FRD-94B	-50.5	-6.66	-11.7	na	na	<0.38	64.8	na	0.251	0.339
IRO-94B	-45.8	-6.54	-15.1	na	na	<0.43	23.6	29.6	0.204	0.186
HPS	-44.1	-7.65	-8.9	-74.6	-182	4.49	53.9		0.251	0.460
Mean	*-45.5*	*-6.96*	*-10.3*	*-76.6*	*-209*	*4.96*	*52.3*		*0.162*	*0.167*
Stddev	*2.6*	*0.37*	*3.5*	*1.7*	*21*	*2.71*	*22.3*		*0.129*	*0.300*
Northeastern Region:										
TMR1	-47.0	-7.11	-15.6				16.7	-1.1	-0.010	-0.276
VER-94b	-43.3	-6.51	-21.3	na	na	<0.45	8.9	-3.5	0.105	-0.056
Mean	*-45.2*	*-6.81*	*-18.5*				*12.8*	*-2.3*	*0.048*	*-0.166*
Stddev	*1.9*	*0.30*	*2.9*				*3.9*	*1.7*	*0.081*	*0.156*

* na – not analyzed

Dedolomitization in the Onarga Valley region of the MA.

Dissolution of gypsum can promote calcite precipitation and dolomite dissolution:

Gypsum dissolution: $CaSO_4 \rightarrow Ca^{2+} + SO_4^{2-}$

Calcite precipitation: $Ca^{2+} + HCO_3^- \rightarrow CaCO_3 + H^+$

Dolomite dissolution: $CaMg(CO_3)_2 + H^+ \rightarrow Ca^{2+} + Mg^{2+} + 2HCO_3^-$

In this situation, as the SO_4^{2-} concentration increases, Ca^{2+} and Mg^{2+} concentrations also increase while the HCO_3^- concentration decreases. This is exactly what was observed for the Onarga Valley samples from the northeastern portion of the MA (Figure DR2a & b).

If dolomite and calcite approach equilibrium, i.e.,

$$Ca^{2+} + CaMg(CO_3)_2 \leftrightarrow 2CaCO_3 + Mg^{2+}$$

then the activity ratio of Mg^{2+} to Ca^{2+} should remain fixed by the equilibrium solubility products for dolomite and calcite (Hsu, 1963; Appelo and Postma, 1996):

$$K_{dol\text{-}calc} = [Mg]/[Ca] = K_{dol.} / K^2_{calc.} = 10^{-17.1} / (10^{-8.5})^2 = 0.8$$

In very dilute solutions, such as most potable waters, the activity coefficients for Ca^{2+} and Mg^{2+} are about the same (Hsu, 1963). Thus, the Mg^{2+}/Ca^{2+} activity and concentration ratio will essentially be equal, which is true for the MA (Hackley, 2002). Using the equilibrium Mg/Ca ratio of 0.8, Appelo and Postma (1996) wrote an overall mass balance for dedolomitization:

$$1.8\ CaSO_4 + 0.8\ CaMg(CO_3)_2 \rightarrow 1.6\ CaCO_3 + Ca^{2+} + 0.8\ Mg^{2+} + 1.8\ SO_4^{2-}$$

The $Ca^{2+}/SO_4^{=2-}$ ratio for groundwater from the Onarga Valley is consistent with this mass balance (Figure DR2a.). However, the Mg^{2+}/SO_4^{2-} data plots below a 0.8:1.8 relationship. Similar characteristics for the Mg^{2+} and SO_4^{2-} data from the Madison aquifer (Plummer et al., 1990; Appelo and Postma, 1996). Appelo and Postma suggested

this was probably due to the solution being over-saturated with respect to calcite (SI_{ca} = +0.2) but, on the average, roughly in equilibrium for dolomite (±0.5). The groundwater in the Onarga Valley also was super-saturated with respect to calcite to about the same degree (Table DR3a & b). Although, only three of the samples collected in this study, one with the highest and two others with relatively high SO_4^{2-} concentrations, had negative dolomite SI from the Onarga Valley. The rest of the samples had positive SI for dolomite. In the case of the MA, dedolomitization may be occurring in the waters with the highest SO_4^{2-} content after which other processes, such as mixing, ion exchange, and SO_4^{2-} reduction probably have more important influences on the ion concentrations.

Boron and Sr discussion from Northeastern part of MA section in paper:

Besides elevated SO_4^{2-} concentrations, groundwater in the vicinity of the northeastern region appears to be anomalously high in other constituents, such as B and Sr. A plot of the concentration of these trace elements versus geographic location along the Mahomet aquifer (Figures DR3 and DR4) indicate greater concentrations of B and/or Sr in several of the groundwater samples located in eastern-central and northeastern part of the bedrock valley aquifer. The elevated B, noted in Panno et al. (1994), and Sr^{2+} concentrations in these samples are characteristic of groundwater upwelling from bedrock units in the northeastern region. However, water from wells in both the Glasford and MA well into Ford and Champaign counties, also seem to have elevated B concentrations, including wells from the Champaign public water well field which contain B concentrations as large as 2.1 mg/L (Woller, 1975). Many of these wells are too far, or are up gradient, from the Onarga Valley and should not be affected by the upwelling

groundwater from that region. Thus the B probably originates from interaction of groundwater with lithology characteristic to the central to northeastern part of the MBV. Boron is typically associated with minerals such as tourmaline, biotite and amphiboles (Hem, 1992) or perhaps with shales and coals (Krauskopf, 1967). The upper Devonian New Albany, the Mississippian Bordin Sitlstone and the Pennsylvanian Tradewater Formations, which are exposed in the bedrock in the northeastern and central parts of the MBV (Kolata et al., 2005), contain coals, shales, siltstones, and argillaceous sandstones some with noticeable mica flakes (Willman et al., 1975) and are probably the primary source of the elevated B in this part of the MA. The source of Sr in many of the wells of the northeastern and some of the central area of the MBV are probably the bedrock Mississippian, Silurian and Devonian carbonates or clastics from these formations which make up most of the exposed bedrock in this part of the MBV.

It appears that not all the water up-welling from bedrock units around the Onarga Valley area passes through the Pennsylvanian shale and coal deposits. Some of the up-welling water may not come in contact with the Spoon and Abbot Formations and thus not become enriched in B, which would explain the elevated Sr, low ^{14}C and low B concentration observed in sample WJ00. This particular sample also had the lowest $\delta^{18}O$ and δD values observed in the MA suggesting that a fraction of the groundwater upwelling in this region is Pleistocene age (> 11,000 yrs old).

DR Figure Captions

Figure DR1. Distribution of specific conductivity for groundwater samples plotted geographically from west to east across the MBV system. Different symbols are used for different regions of the MBV. Closed symbols are all from the Mahomet aquifer while open symbols are from the shallower Glasford and Wedron aquifers.

Figure DR2. Comparison of the concentrations of Ca^{2+} and Mg^{2+} (a.) and $HCO_3^{!}$ (b.) with SO_4^{2-} for the MBV system. Samples from the Onarga valley are delineated with a hatched pattern ($r^2 = 0.97$ for both Ca^{2+} and Mg^{2+} vs SO_4^{2-}). The line in (a.) shows the expected trend for waters characterized by dedolomitization and in equilibrium with calcite, see text.

Figure DR3. Boron concentration in groundwater versus geographic location from west to east in the aquifers of the MBV system. Unfortunately little boron data was collected for the confluence area. (Those samples with below detection limit results were plotted at one half the detection limit).

Figure DR4. Strontium concentration in groundwater versus geographic location from west to east in the aquifers of the MBV system.

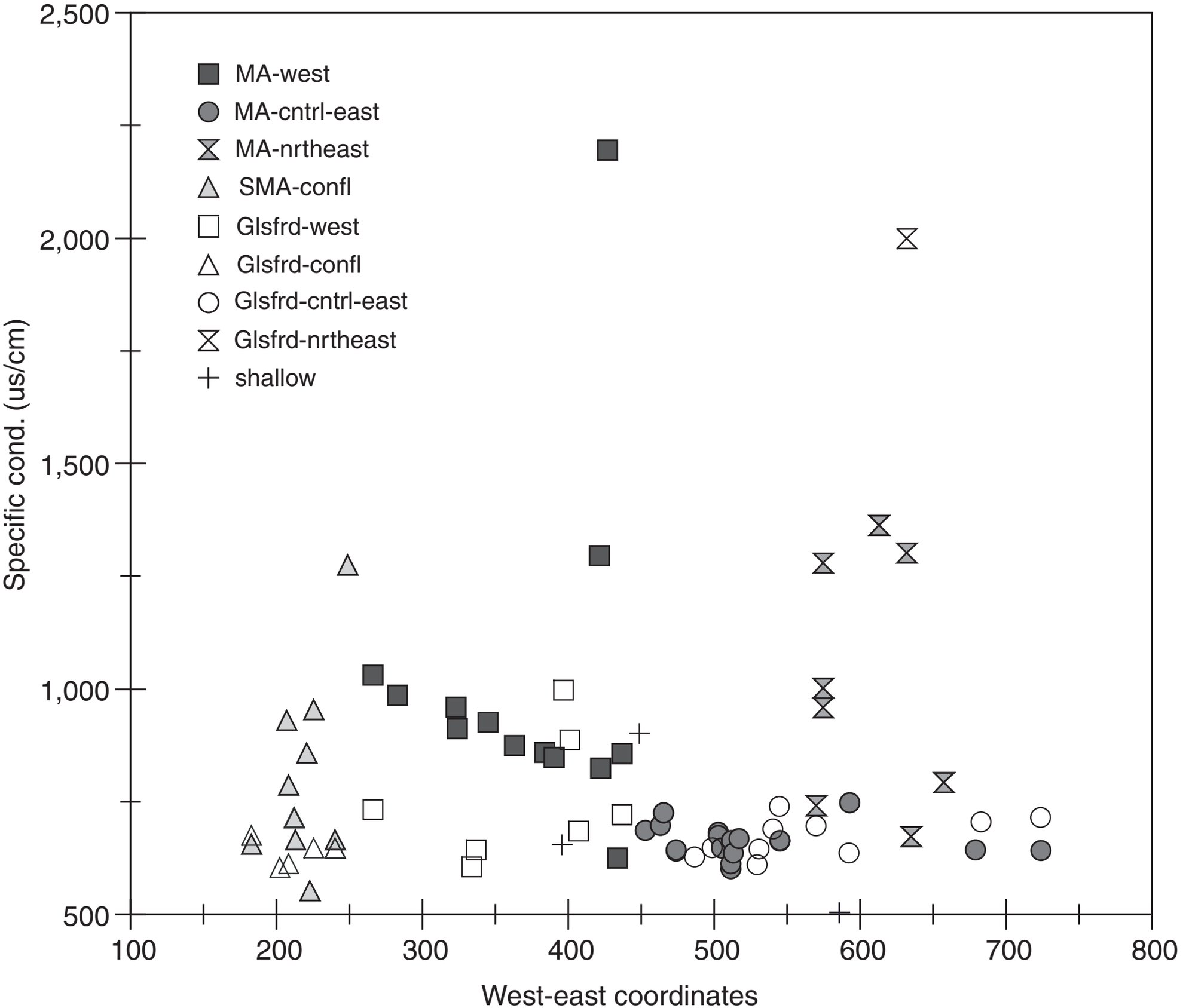
MA-west
MA-cntrl-east
MA-nrtheast
SMA-confl
Glsfrd-west
Glsfrd-confl
Glsfrd-cntrl-east
Glsfrd-nrtheast
shallow
Specific cond. (us/cm)
2,500
2,000
1,500
1,000
500
100
200
300
400
500
600
700
800
West-east coordinates

Figure DR 1

a.

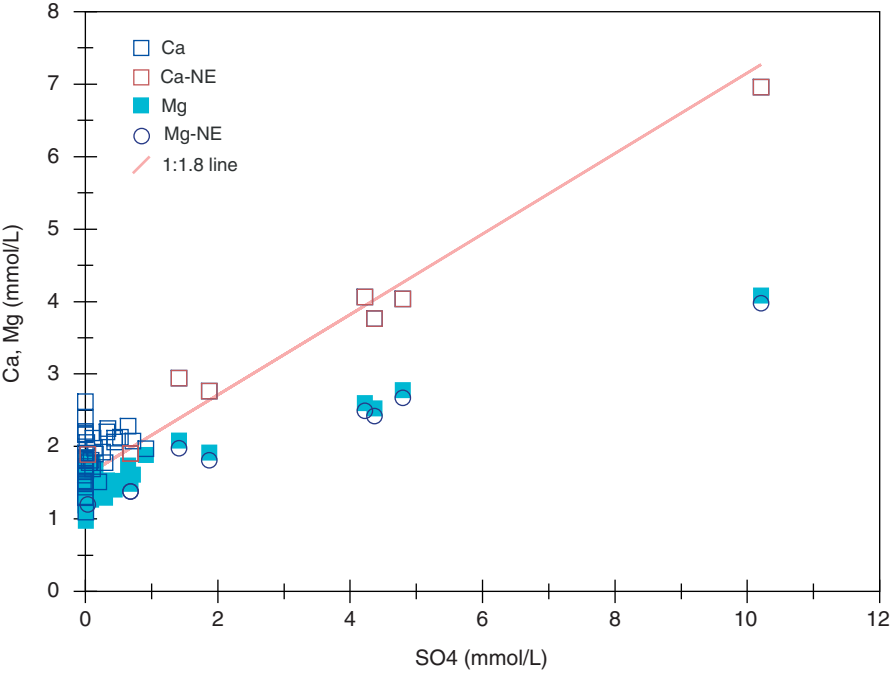
Ca
Ca-NE
Mg
Mg-NE
1:1.8 line
Ca, Mg (mmol/L)
SO4 (mmol/L)
0
1
2
3
4
5
6
7
8
0
2
4
6
8
10
12

Figure DR 2

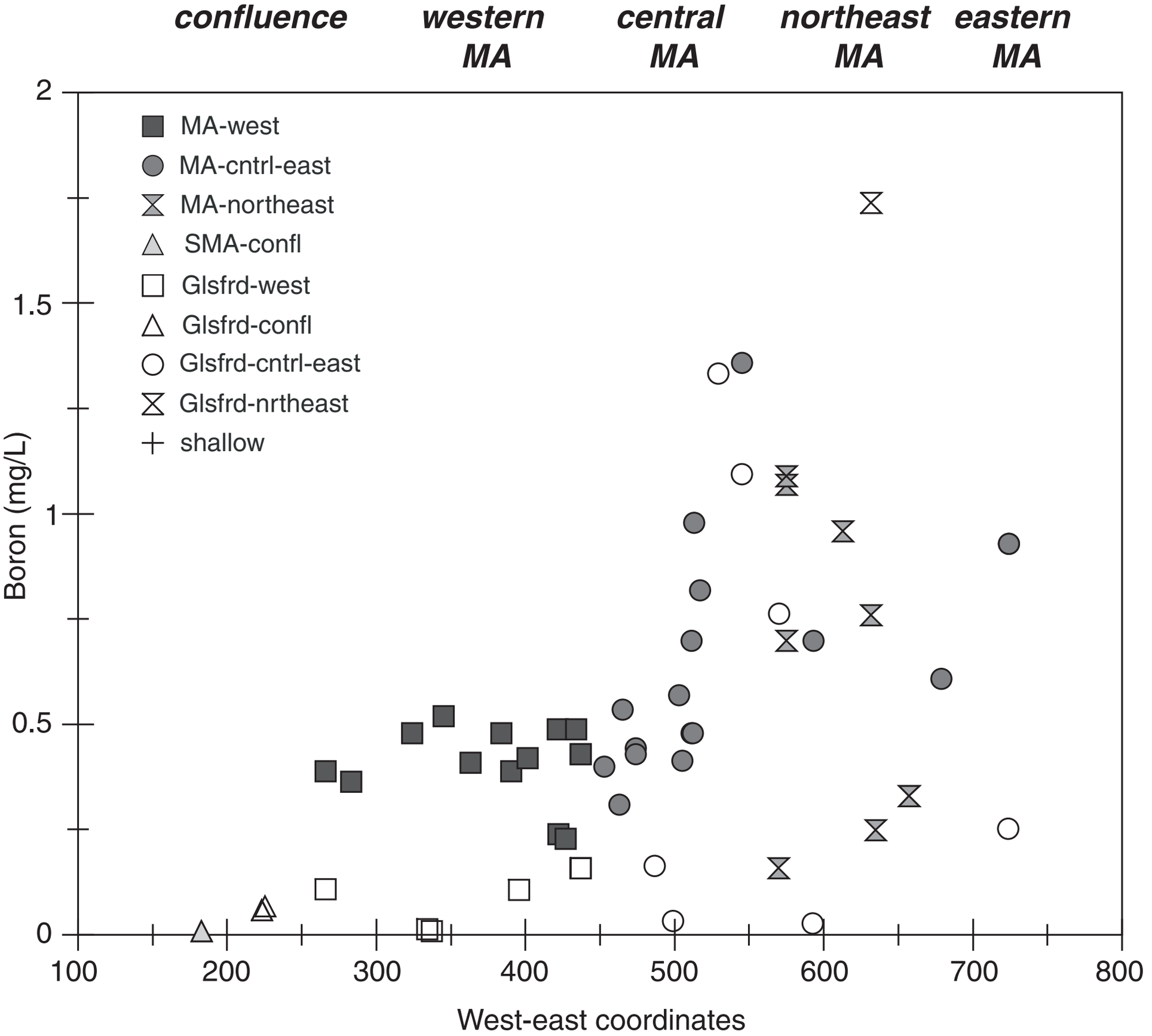
confluence
western MA
central MA
northeast MA
eastern MA
MA-west
MA-cntrl-east
MA-northeast
SMA-confl
Glsfrd-west
Glsfrd-confl
Glsfrd-cntrl-east
Glsfrd-nrtheast
shallow
Boron (mg/L)
0
0.5
1
1.5
2
100
200
300
400
500
600
700
800
West-east coordinates

Figure DR 3

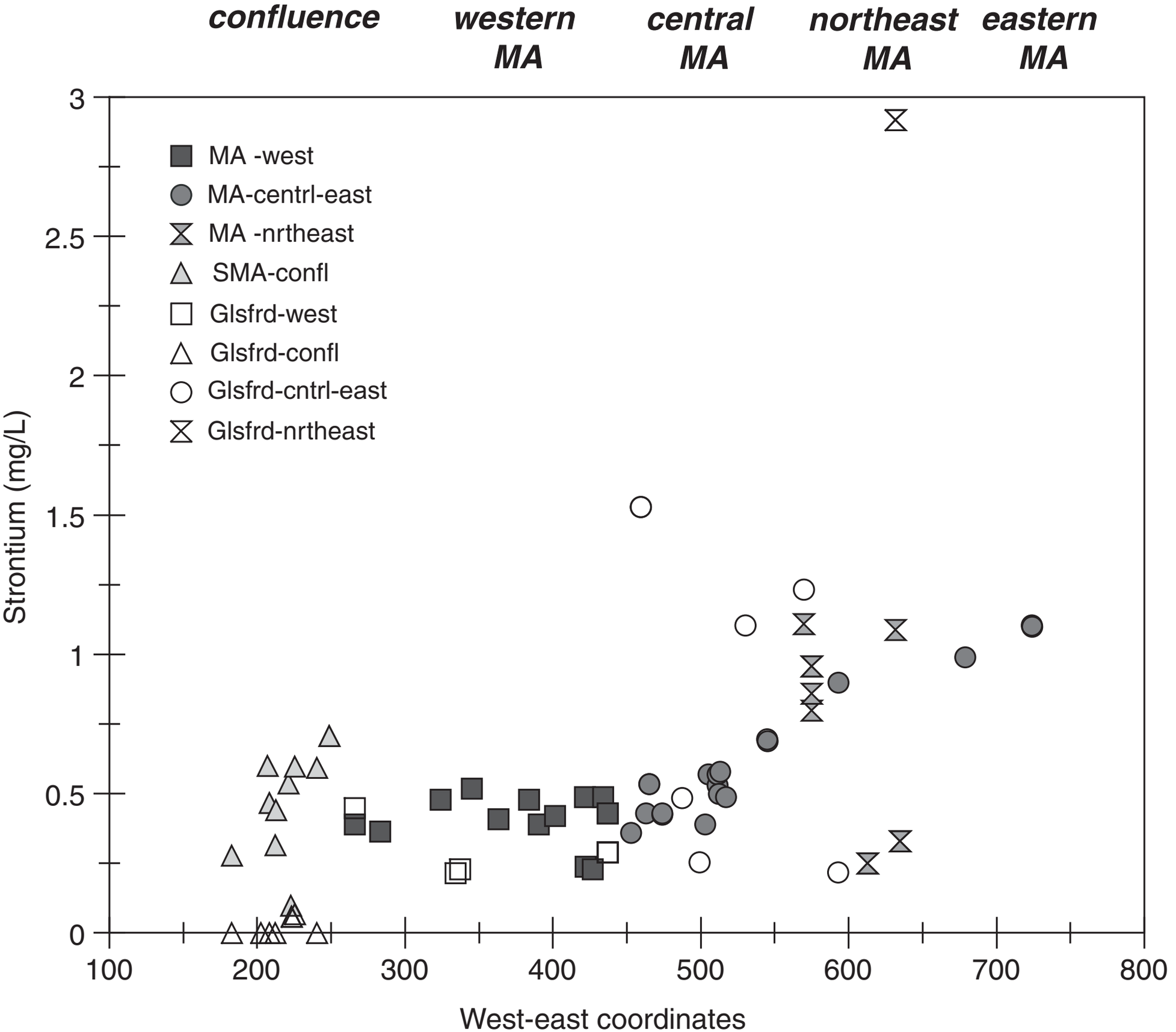
confluence
western MA
central MA
northeast MA
eastern MA
MA -west
MA-centrl-east
MA -nrtheast
SMA-confl
Glsfrd-west
Glsfrd-confl
Glsfrd-cntrl-east
Glsfrd-nrtheast
Strontium (mg/L)
0
0.5
1
1.5
2
2.5
3
100
200
300
400
500
600
700
800
West-east coordinates

Figure DR 4