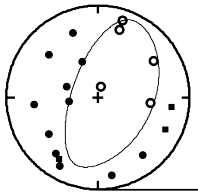

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November 5, 2014

WEEKLY REPORT #5 TO ALTAROCK ENERGY INC.

PROCESSING OF INDUCED EARTHQUAKES ASSOCIATED WITH THE NEWBERRY EGS INJECTION STARTING SEPTEMBER 2014

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Brief summary

During the last week, additional results obtained for relative locations of the moment-tensor events, and and additonal 10 moment tensors have served to strengthen earlier results:

1. *The earthquakes form a pair of clusters, one near the bottom of the well and the other ~ 200 m deeper. Both lie on the same planar structure that strikes approximately NW and dips steeply to the NE. The deeper cluster lies further to the SE than the shallower cluster.*
2. *Moment tensors show a strong clustering of T-axes (approximately the direction of σ_3) orientated sub-horizontally S±20˚ or so. The P-axes (approximately the direction of σ_1) are most strongly clustered approximately horizontally and in the NNE to ENE direction though there is more scatter than is the case for the T-axes.*

The pattern of earthquake source types observed earlier remains constant with the addition of more results. The source types range from +Dipole to -Dipole with approximately equal numbers of earthquakes showing crack-opening and crack-closure.

1 Task 1 – Planning, conference calls, discussion of work, correspondence, followup

We continued to maintain light contact with team members. The work now runs on a fairly routine basis.

2 Task 2 – System Setup

System setup is complete for the present.

3 Task 3 – Quality control of prepicked MEQs and preparation for relocation and moment tensor calculation

We continued to derive moment tensors using the procedure described in our Weekly Report #1. We report here an additional 10 moment tensors. The entire list of earthquakes processed to date is given in

Table 1. We have provided the locations and moment tensor decomposition data of these new moment tensors to Trenton Cladouhos of AltaRock electronically, by email attachment.

Table 1: The 44 earthquakes for which moment tensors have been obtained to date. Locations given below are from the webpage http://fracture.lbl.gov/Newberry/locations.txt.

jday	month	day	hour	minute	sec	lat	lon	depth	magnitude
273	9	30	9	23	48.799	43.71965	-121.30908	0.854	0.853
273	9	30	21	30	43.689	43.72667	-121.313	0.387	0.972
274	10	1	1	3	14.64	43.7239	-121.30957	0.714	0.987
274	10	1	8	8	58.215	43.72623	-121.31412	1.196	0.848
274	10	1	10	50	55.229	43.72275	-121.30868	1.051	0.787
274	10	1	12	3	16.881	43.72658	-121.3158	1.587	1.086
274	10	1	14	53	5.102	43.72545	-121.31355	0.613	1.381
274	10	1	15	1	55.056	43.72775	-121.31227	0.923	0.682
274	10	1	16	56	11.256	43.72232	-121.30712	1.65	0.901
274	10	1	19	5	16.377	43.72662	-121.31117	0.517	1.259
275	10	2	6	38	47.428	43.7243	-121.31328	1.153	0.951
275	10	2	6	47	52.916	43.72632	-121.31322	1.323	1.117
275	10	2	7	7	11.646	43.72488	-121.31192	0.708	1.378
275	10	2	11	1	48.042	43.72567	-121.31168	0.666	1.22
275	10	2	12	39	9.082	43.7264	-121.31438	1.332	0.852
275	10	2	18	53	48.447	43.72082	-121.31372	1.671	0.957
275	10	2	20	36	50.997	43.72377	-121.31323	1.499	0.991
276	10	3	6	6	22.727	43.72528	-121.31493	0.928	1.157
276	10	3	15	27	57.912	43.72257	-121.31562	1.054	0.919
276	10	3	18	54	54.199	43.72678	-121.31125	0.647	1.021
277	10	4	5	29	8.347	43.72578	-121.31068	0.946	0.922
277	10	4	17	32	52.716	43.72207	-121.31693	0.376	1.521
277	10	4	18	51	11.991	43.72295	-121.31227	0.496	1.97
278	10	5	2	6	17.079	43.7266	-121.31217	0.925	0.86
278	10	5	4	7	30.446	43.725	-121.31322	0.659	1.696
278	10	5	15	55	21.373	43.73483	-121.30918	0.702	0.695
278	10	5	16	7	32.904	43.7253	-121.30967	1.205	0.819
278	10	5	23	22	16.638	43.72368	-121.3116	1.055	0.931
280	10	7	10	47	21.079	43.72403	-121.3095	1.136	0.822
282	10	9	6	24	33.517	43.72232	-121.31203	0.735	0.769
284	10	11	3	29	5.813	43.72417	-121.31338	0.409	0.852
284	10	11	10	53	26.568	43.72493	-121.30897	1.292	0.824
285	10	12	10	12	29.727	43.7257	-121.3135	0.783	0.863
285	10	12	16	37	43.42	43.72515	-121.3151	0.49	1.482

285	10	12	18	33	4.878	43.72363	-121.30787	0.359	0.743
285	10	12	21	10	18.995	43.72783	-121.31002	0.653	0.792
286	10	13	0	57	6.873	43.72382	-121.3175	0.242	1.197
286	10	13	4	12	29.232	43.72657	-121.30698	0.882	1.179
286	10	13	10	22	29.146	43.7302	-121.3153	0.831	0.907
287	10	14	5	46	14.161	43.71765	-121.31087	0.161	0.904
288	10	15	15	3	44.691	43.72658	-121.30768	0.897	0.781
288	10	15	15	37	26.034	43.72713	-121.30915	0.934	0.883
291	10	18	23	57	3.867	43.72965	-121.31732	0.116	0.781
292	10	19	9	7	50.375	43.73525	-121.3113	0.837	0.776

4 Task 4 –Improved locations and relative locations

4.1 Absolute locations

Only a few earthquakes have occurred since our last report and the pattern of absolute locations is not significantly different from what we reported 29 October. We have thus not updated our relocation maps.

We have updated our map of events for which moment tensors were derived and the full 44-event dataset is shown in Figure 1.

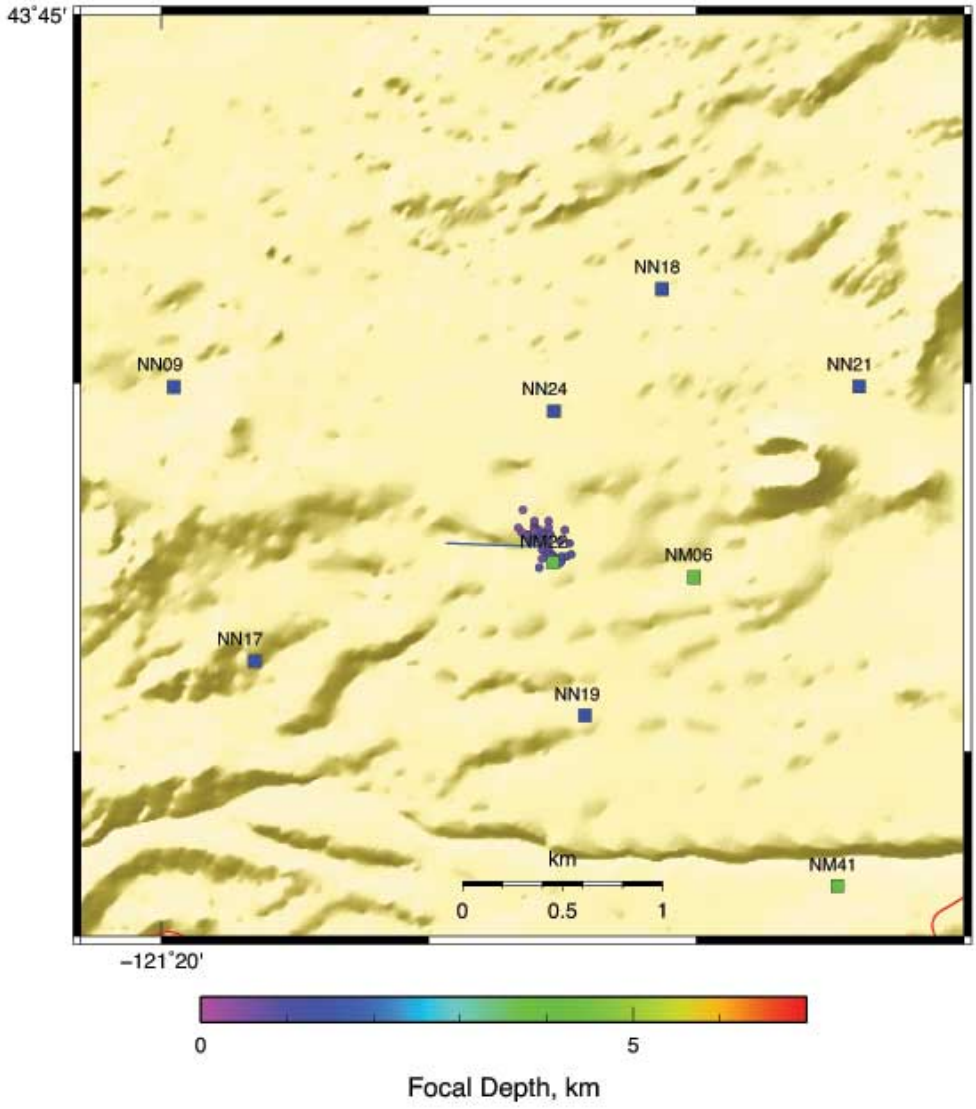


Figure 1: High quality estimated hypocenters of 44 microearthquakes that occurred between Sept. 30 and Oct. 19, 2014, and for which moment tensors were derived. These locations are computed using arrival times measured carefully in connection with the moment-tensor analysis. Well NWD 55-29 is shown in blue.

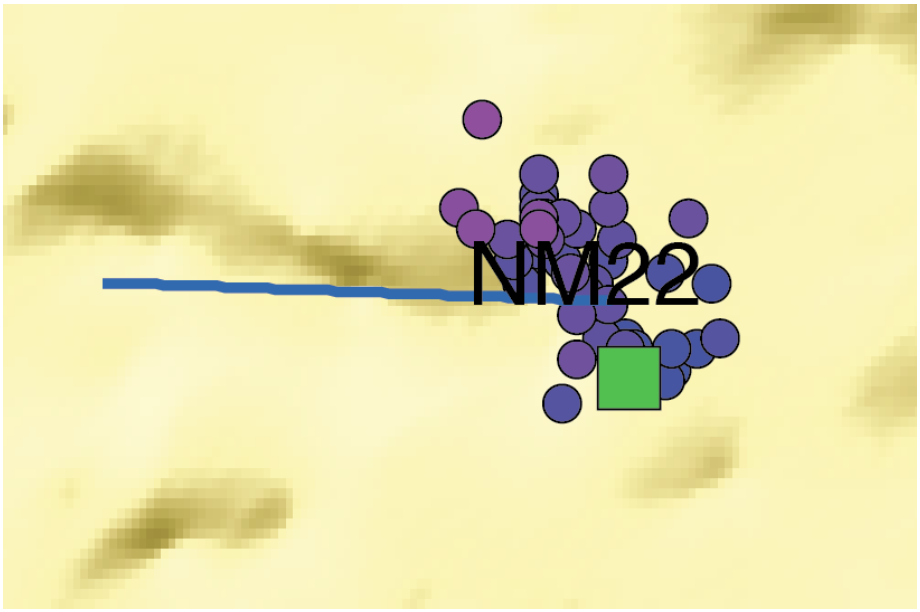


Figure 2: Expanded view of the locations of the earthquakes for which moment tensors were derived.

4.2 Relative locations

We continued with the relative loction work, applying the method to the 44 earthquakes for which moment tensors have been derived. These events are the best-located set currently available. We used the same procedure as described in our report of 29 October.

In order to fix the absolute location of the moment-tensor cluster, we pinnned it to the earthquake that occurred 2014 10 01 08 08 57.998 at a latitude of 43.725528, longitude of -121.308941 and depth of 1.21 km b.s.l.

We performed a number of relative location inversions and finally settled on the following run-time parameters:

- *minclust*–the minimum number of earthquakes to define a cluster (a value of 10 was used);
- *maxit*–the maximum allowed number of relocation iterations (optimal value identified = 5);
- *maxsep*–the maximum separation allowed between linked pairs of earthquakes (optimal value identified = 0.2 km);
- *minlinks*–the minimum number of "links" (i.e., measured station/phases in common between pairs of earthquakes) needed for an earthquake to be passed to the final relocated set (optimal values identified = 18);

The results are shown in Figure 3, Figure 4 and Figure 5. The original input dataset comprised 44 earthquakes, totalling 1135 arrival times. 36 earthquakes passed the stringent quality control parameters and were relocated as one cluster.

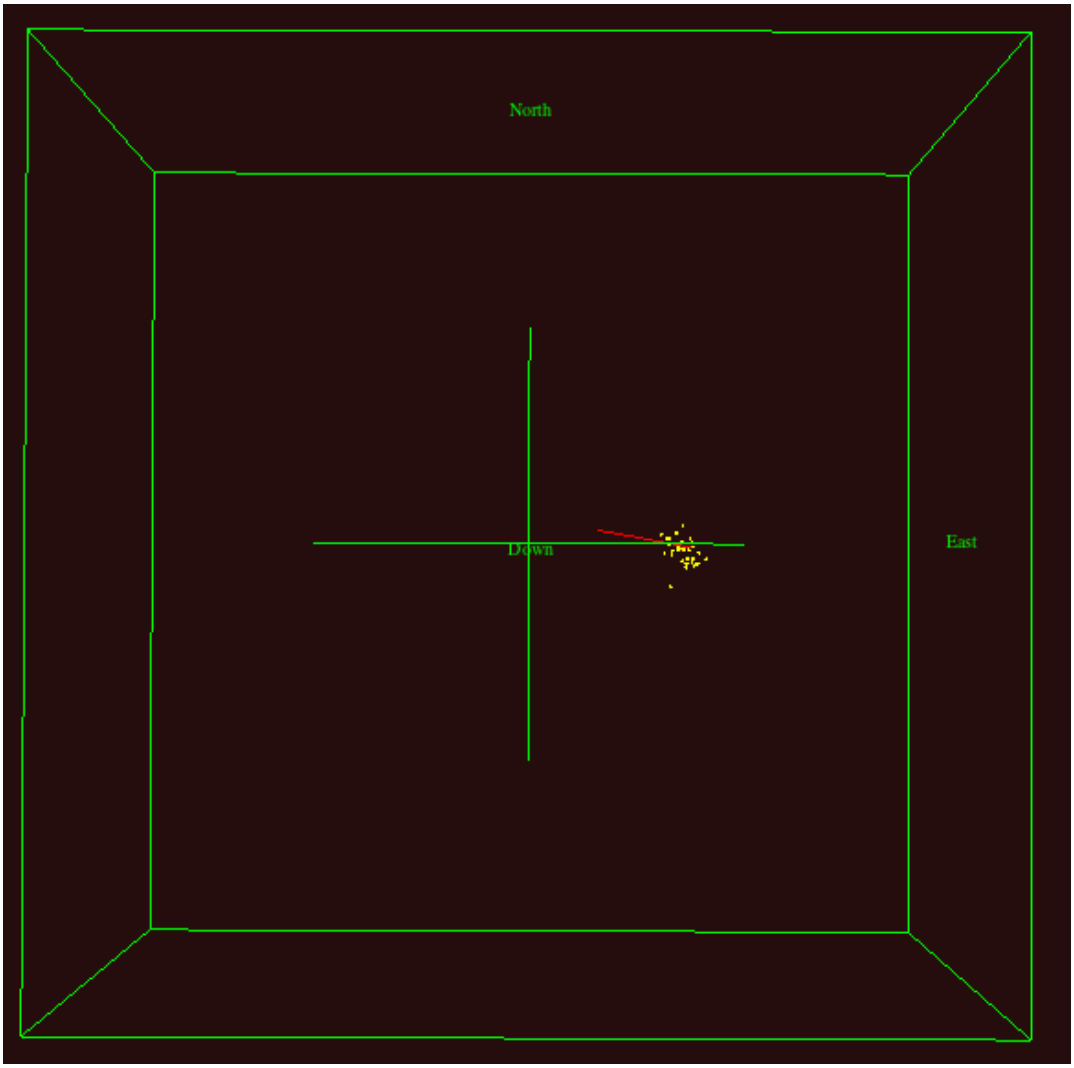


Figure 3: Map of relative locations of 36 moment-tensor earthquakes that occurred in the time period 30 September - 19 October, 2014. Runtime parameters used were *minclust* = 5, *maxit* = 5, *maxsep* = 0.2 km, *minlinks* = 18.

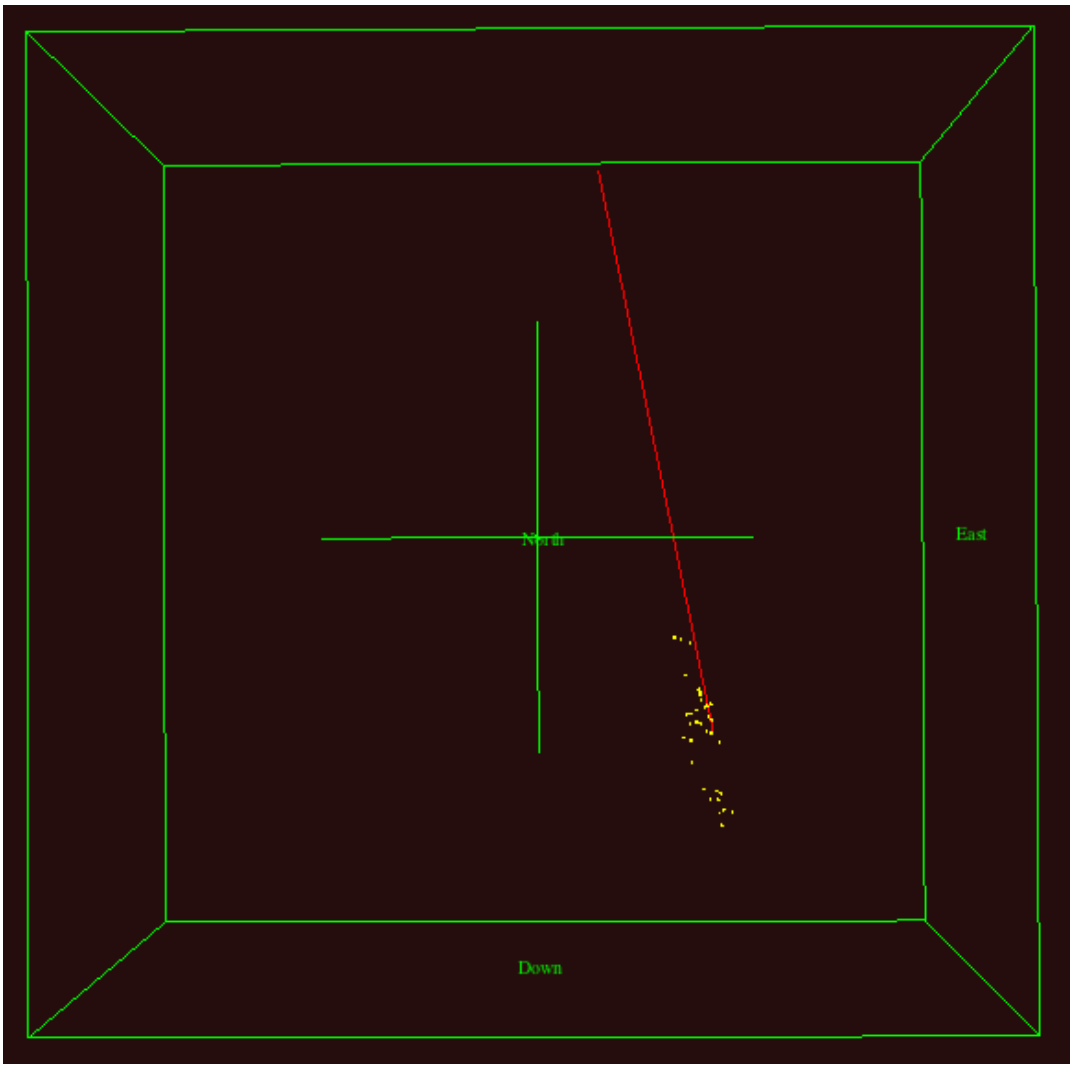


Figure 4: Same as Figure 3 except in cross section looking north.

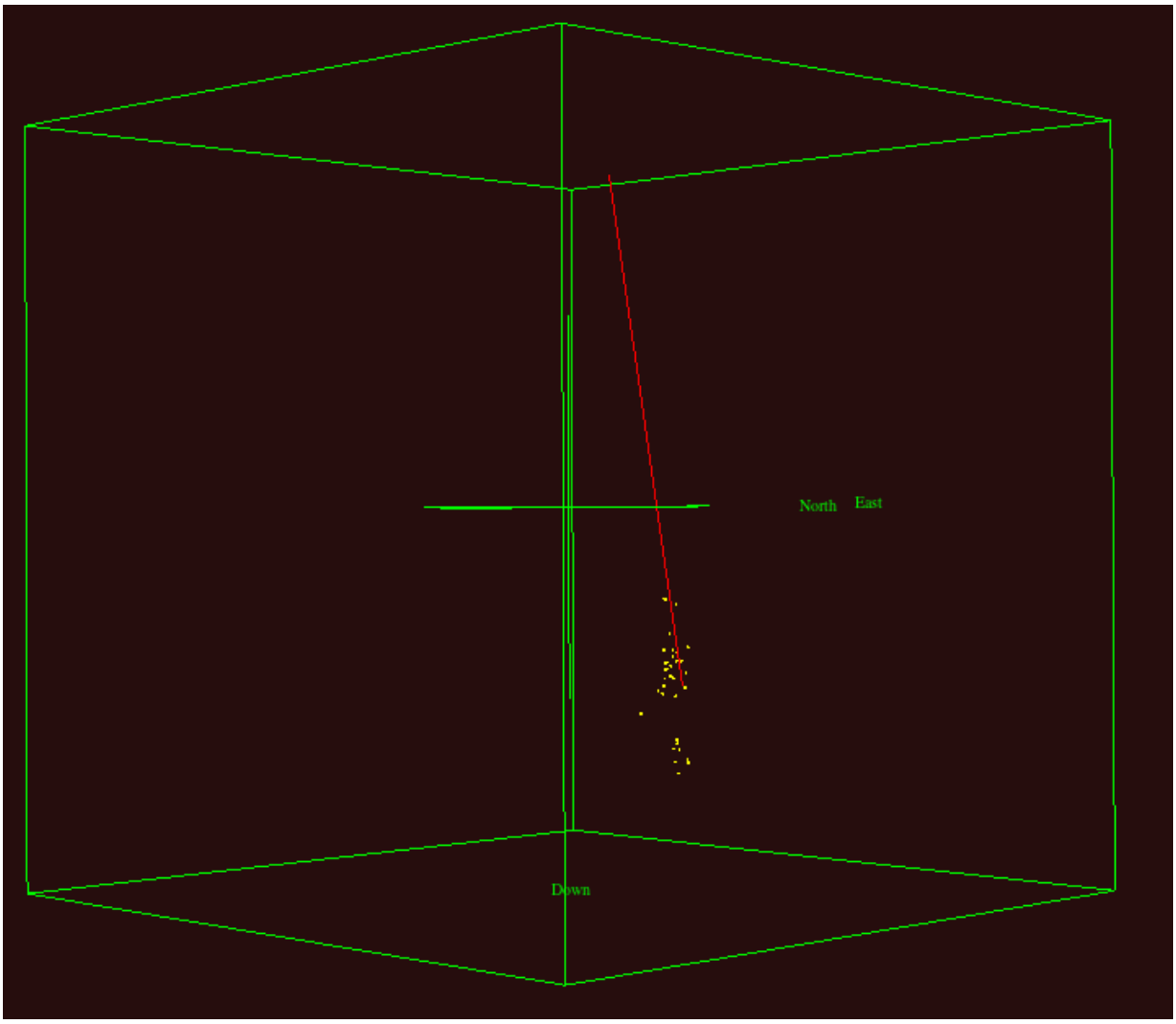


Figure 5: Same as Figure 3 except in cross section looking northwesterly, along the strike of the planar structure.

The relative location results described in our last report are confirmed when only the moment-tensor events are used. A clear linear zone is delineated that strikes at ~ N 45˚W. In map view it looks more diffuse than it actually is because the events lie on a steeply dipping planar structure. The observation of two groups of earthquakes, on near the bottom of well NWD 55-29 and the other ~ 200 m deeper, is confirmed.

Numerical data for these interim results have been provided to AltaRock by email attachment to Trenton Cladouhos.

5 Task 5 Moment tensor calculations

Moment tensors were derived for an additional 10 earthquakes using the same procedure as described in Weekly Report #1. The numerical results of the catalog to date are given in

Table 2. Graphical results for the additional events are shown in Appendix 1.

The source types for the entire 44-event set are shown in source-type space in Figure 6. The distribution remains similar to that reported earlier.

Figure 7 shows a plot of the P-, T- and I-axes, approximately corresponding to the directions of σ_1, σ_3 and σ_2. The addition of more earthquakes has strengthened the distribution seen earlier whereby most T axes cluster systematically subhorizontally and to the S ± 20˚ or so. The orientations of the P-axes are showing some clustering in a sub-horizontal orientation to the NNE-ENE directions. The I-axes are more scattered.

Table 2: Numerical moment tensor results for the 44 MEQs studied to date. N=North, E=East, D=Down.

NN	NE	EE	ND	ED	DD	Year	Mo	Day	Hr	min	Sec	Quality
6.49E-02	-9.50E-02	-2.84E-01	6.74E-02	1.45E-01	-3.58E-02	2014	9	30	9	23	48.626	good
-2.67E-01	1.32E-01	-6.40E-02	6.06E-02	1.03E-01	7.79E-02	2014	9	30	21	30	43.503	excellent
-1.78E-01	-1.05E-01	-1.51E-01	7.11E-02	1.06E-01	1.06E-01	2014	10	1	1	3	14.49	excellent
1.48E-01	-1.18E-01	-1.49E-01	1.58E-01	-3.13E-02	9.55E-02	2014	10	1	8	8	57.998	excellent
-3.26E-02	2.22E-01	-3.37E-01	1.64E-02	7.16E-02	9.88E-03	2014	10	1	10	50	55.107	excellent
2.00E-01	-1.41E-01	-1.46E-01	1.40E-01	-8.71E-03	7.41E-02	2014	10	1	12	3	16.94	good
1.58E-01	3.47E-02	6.67E-02	2.48E-01	6.32E-02	8.34E-02	2014	10	1	14	53	5.23	excellent
-1.04E-01	1.46E-01	-2.54E-01	1.25E-01	-1.33E-02	7.34E-02	2014	10	1	15	1	54.95	excellent
-2.21E-01	-8.13E-02	-2.19E-02	-1.52E-01	3.52E-02	2.20E-01	2014	10	1	16	56	11.343	good
2.17E-01	-3.67E-02	-6.42E-02	2.35E-01	7.20E-02	3.18E-02	2014	10	1	19	5	16.54	excellent
1.62E-01	4.20E-02	-2.04E-01	2.16E-01	-2.04E-02	7.76E-02	2014	10	2	6	39	2.998	excellent
-1.46E-02	9.64E-02	-3.98E-01	2.60E-02	1.69E-01	-4.69E-03	2014	10	2	6	47	52.94	excellent
-1.17E-01	1.71E-01	-1.99E-01	1.39E-01	-2.43E-02	1.64E-02	2014	10	2	7	7	4.16	excellent
2.41E-01	-7.30E-02	-9.79E-02	1.73E-01	4.30E-02	8.35E-02	2014	10	2	11	1	42.38	excellent
-6.57E-02	-1.85E-01	-1.14E-01	1.69E-01	4.18E-02	2.83E-02	2014	10	2	12	39	24.317	good
2.31E-03	-1.80E-01	-9.21E-02	2.20E-01	-4.35E-03	9.59E-02	2014	10	2	18	54	3.152	good
1.42E-01	-1.37E-	-1.64E-	1.72E-01	1.08E-02	5.38E-02	201	1	2	2	37	6.043	good

	01	01				4	0		0			
6.07E-03	-2.23E-01	-9.16E-02	1.94E-01	3.37E-02	-6.18E-04	2014	10	3	6	6	22.76	excellent
2.45E-01	-8.11E-02	-1.97E-01	1.74E-01	1.62E-02	1.51E-02	2014	10	3	15	27	57.661	good
-5.77E-02	-1.66E-01	-1.43E-01	1.46E-01	7.81E-02	-1.95E-02	2014	10	3	18	54	53.93	fair
1.68E-01	-3.35E-02	-9.83E-03	2.95E-01	3.54E-02	9.35E-02	2014	10	4	5	29	8.258	fair
-1.03E-01	1.33E-01	-1.19E-01	1.48E-01	5.51E-02	1.07E-01	2014	10	4	17	32	52.76	excellent
8.71E-02	1.26E-01	-4.19E-02	1.81E-01	8.43E-02	8.72E-02	2014	10	4	18	51	12	excellent
-1.37E-01	-1.84E-01	-5.91E-02	1.61E-01	-1.12E-02	9.22E-02	2014	10	5	2	6	16.967	excellent
5.30E-02	6.78E-02	-1.18E-01	1.62E-01	7.51E-02	2.21E-01	2014	10	5	4	7	20	excellent
-2.29E-01	1.61E-01	-7.21E-02	-9.28E-02	8.01E-02	-3.22E-02	2014	10	5	15	55	21.007	good
2.87E-01	-3.71E-02	-1.79E-01	9.26E-02	1.26E-01	2.27E-02	2014	10	5	16	7	32.777	excellent
-1.87E-01	9.00E-02	-9.47E-02	-1.45E-01	-2.49E-02	1.99E-01	2014	10	5	23	22	16.499	good
4.38E-02	2.44E-01	-1.80E-01	4.37E-02	9.99E-02	-2.18E-05	2014	10	7	10	47	20.916	good
2.44E-02	7.10E-02	-2.43E-02	-8.64E-02	-1.62E-01	3.13E-01	2014	10	9	6	24	33.418	excellent
-1.43E-01	-1.36E-01	3.35E-03	1.56E-01	-5.83E-02	1.55E-01	2014	10	11	3	29	5.667	good
3.71E-03	3.87E-02	-3.57E-01	5.61E-02	2.09E-01	2.16E-02	2014	10	11	10	53	26.502	good
-1.35E-01	-1.17E-01	-4.10E-02	2.00E-01	-5.35E-02	8.30E-02	2014	10	12	10	12	29	good
-4.88E-01	-1.02E-01	5.62E-02	5.97E-02	-1.84E-03	1.29E-01	2014	10	12	16	37	43.287	excellent
2.03E-01	-2.42E-02	-3.05E-01	1.71E-01	-4.33E-02	1.58E-02	2014	10	12	18	33	4.693	moderate
-2.21E-01	1.54E-01	4.96E-02	9.04E-02	8.19E-02	7.60E-02	2014	10	12	21	10	23.311	good
-5.87E-02	-1.25E-01	-2.80E-01	6.12E-02	1.41E-01	6.33E-03	2014	10	13	0	57	6.717	good
2.61E-02	-1.18E-01	-2.89E-01	8.03E-02	1.23E-01	4.15E-02	2014	10	13	4	12	29.126	excellent
-1.16E-01	-1.39E-01	-1.17E-01	1.51E-01	5.54E-02	7.56E-02	2014	10	13	10	22	29.084	excellent
-1.13E-01	-2.73E-02	-2.41E-01	5.66E-02	5.18E-02	3.75E-01	2014	10	14	5	46	13.914	exellent
-1.27E-01	-1.70E-01	3.34E-02	1.57E-01	-5.42E-02	7.86E-02	2014	10	15	15	3	44.602	excellent
-5.10E-02	-1.76E-01	-8.51E-02	1.95E-01	1.28E-03	1.20E-01	2014	10	15	15	37	25.945	excellent
-4.20E-02	-1.46E-01	-3.20E-01	-5.38E-04	1.43E-01	5.83E-02	2014	10	18	23	57	3.695	good
-1.86E-01	8.58E-02	-2.76E-01	1.40E-01	-1.35E-02	6.01E-02	2014	10	19	9	7	50.325	good

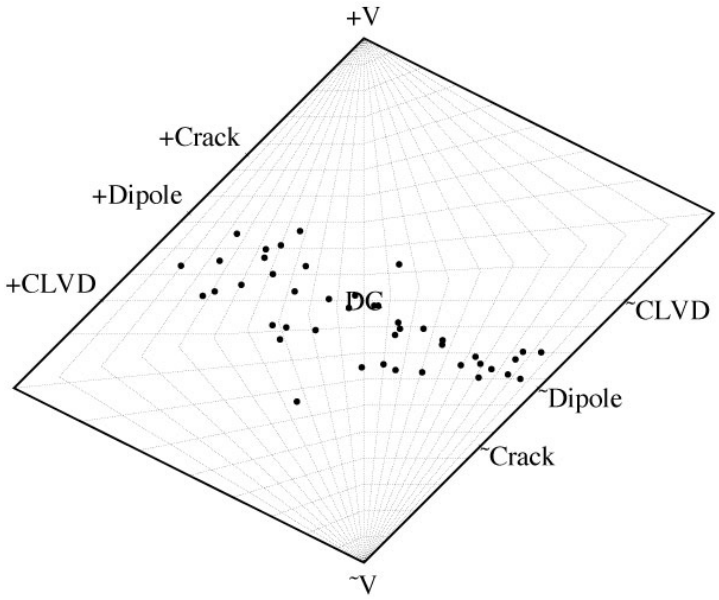


Figure 6: Source-type plot showing the 44 earthquakes for which moment tensors have been derived to date.

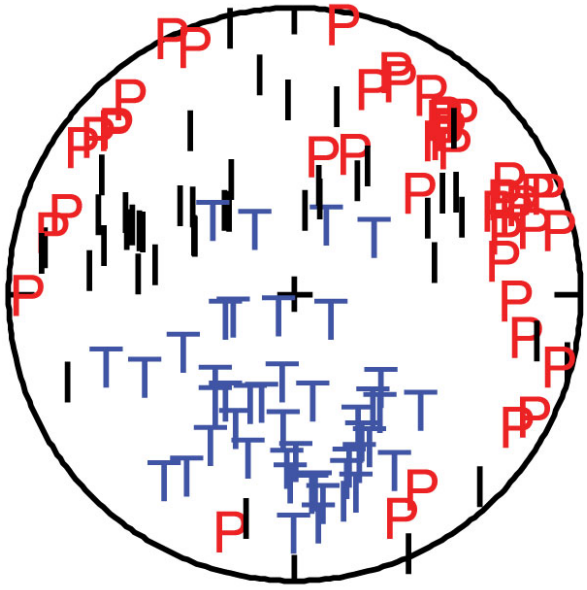


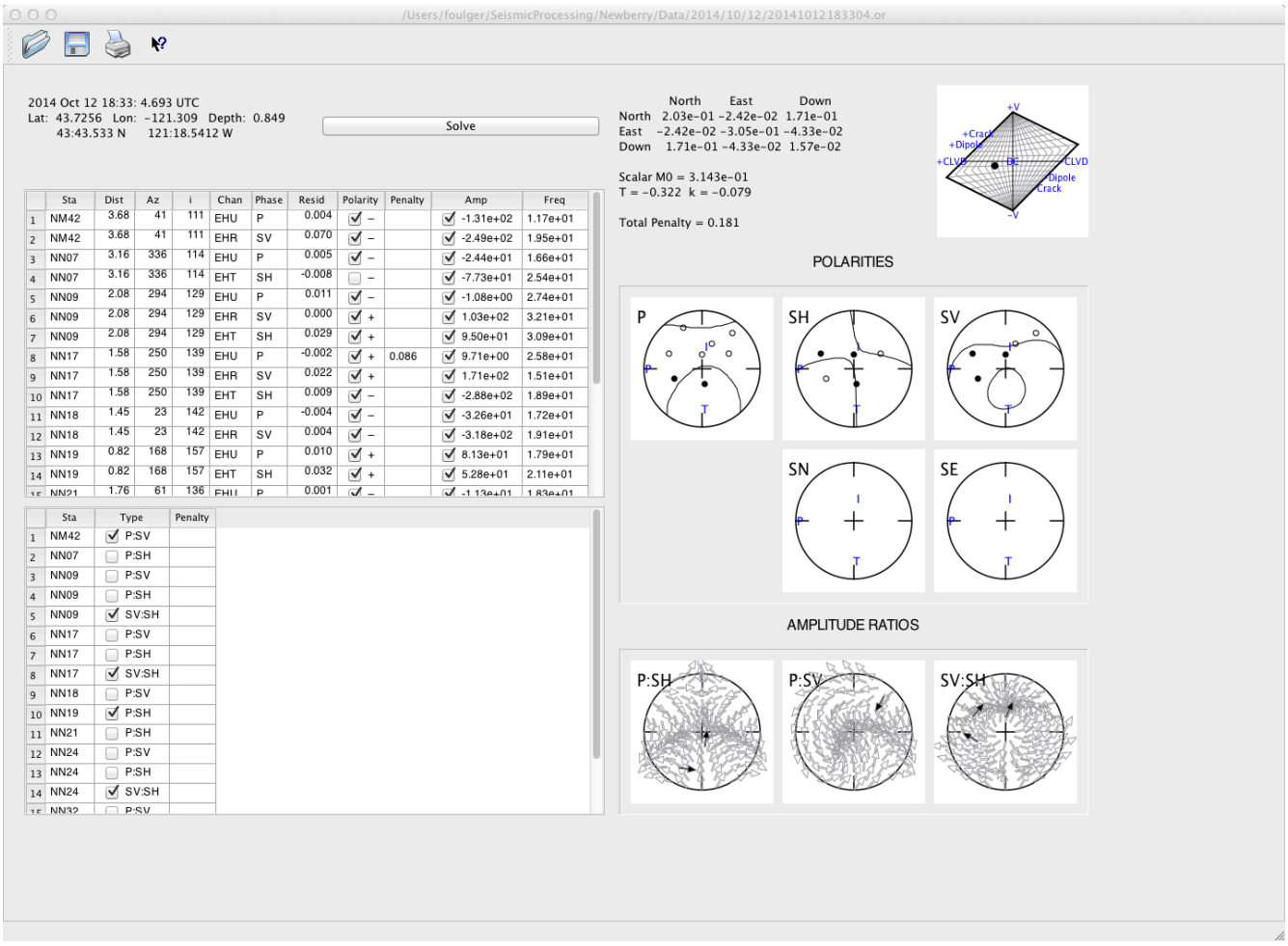
Figure 7: Plot of pressure (P ~ σ_1) and tension (T ~ σ_3) and intermediate (I ~ σ_2) axes for the 44 earthquakes for which moment tensors have been derived to date.

6 Brief summary statement

During the last week, additional results obtained for relative locations of the moment-tensor events, and and additonal 10 moment tensors have served to strengthen earlier results:

3. The earthquakes form a pair of clusters, one near the bottom of the well and the other ~ 200 m deeper. Both lie on the same planar structure that strikes approximately NW and dips steeply to the NE. The deeper cluster lies further to the SE than the shallower cluster.
4. Moment tensors show a strong clustering of T-axes (approximately the direction of σ_3) orientated sub-horizontally S±20˚ or so. The P-axes (approximately the direction of σ_1) are most strongly clustered approximately horizontally and in the NNE to ENE direction though there is more scatter than is the case for the T-axes.
5. The pattern of earthquake source types observed earlier remains constant with the addition of more results. The source types range from +Dipole to -Dipole with approximately equal numbers of earthquakes showing crack-opening and crack-closure.

Appendix 1: The additional nine moment tensors derived over the reporting week.



	Sta	Dist	Az	i	Chan	Phase	Resid	Polarity	Penalty	Amp	Freq
1	NM42	3.68	41	111	EHU	P	0.004	–		-1.31e+02	1.17e+01
2	NM42	3.68	41	111	EHR	SV	0.070	–		-2.49e+02	1.95e+01
3	NN07	3.16	336	114	EHU	P	0.005	–		-2.44e+01	1.66e+01
4	NN07	3.16	336	114	EHT	SH	-0.008	–		-7.73e+01	2.54e+01
5	NN09	2.08	294	129	EHU	P	0.011	–		-1.08e+00	2.74e+01
6	NN09	2.08	294	129	EHR	SV	0.000	+		1.03e+02	3.21e+01
7	NN09	2.08	294	129	EHT	SH	0.029	+		9.50e+01	3.09e+01
8	NN17	1.58	250	139	EHU	P	-0.002	+	0.086	9.71e+00	2.58e+01
9	NN17	1.58	250	139	EHR	SV	0.022	+		1.71e+02	1.51e+01
10	NN17	1.58	250	139	EHT	SH	0.009	–		-2.88e+02	1.89e+01
11	NN18	1.45	23	142	EHU	P	-0.004	–		-3.26e+01	1.72e+01
12	NN18	1.45	23	142	EHR	SV	0.004	–		-3.18e+02	1.91e+01
13	NN19	0.82	168	157	EHU	P	0.010	+		8.13e+01	1.79e+01
14	NN19	0.82	168	157	EHT	SH	0.032	+		5.28e+01	2.11e+01
15	NN21	1.76	61	136	EHU	P	0.001	–		-1.13e+01	1.83e+01

	Sta	Type	Penalty
1	NM42	P:SV	
2	NN07	P:SH	
3	NN09	P:SV	
4	NN09	P:SH	
5	NN09	SV:SH	
6	NN17	P:SV	
7	NN17	P:SH	
8	NN17	SV:SH	
9	NN18	P:SV	
10	NN19	P:SH	
11	NN21	P:SH	
12	NN24	P:SV	
13	NN24	P:SH	
14	NN24	SV:SH	
15	NN32	P:SV	

/Users/foulger/SeismicProcessing/Newberry/Data/2014/10/19/20141019090750.or

2014 Oct 19 9: 7:50.325 UTC
Lat: 43.7259 Lon: -121.313 Depth: 0.656
43:43.5534 N 121:18.7752 W

Solve

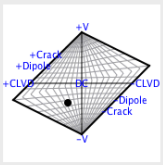
	Sta	Dist	Az	i	Chan	Phase	Resid	Polarity	Penalty	Amp	Freq
1	NM06	1.04	98	150	EHU	P	0.049	☑ +	0.001	☑ 4.83e+01	1.39e+01
2	NM06	1.04	98	150	EHR	SV	0.121	☑ +		☑ 1.97e+02	2.36e+01
3	NM06	1.04	98	150	EHT	SH	0.132	☐ –		☑ -7.00e+02	1.59e+01
4	NM22	0.33	103	170	EHU	P	-0.025	☑ +		☑ 3.32e+01	1.44e+01
5	NM22	0.33	103	170	EHT	SH	-0.046	☑ +		☑ 2.59e+02	1.54e+01
6	NN07	3.01	341	110	EHU	P	0.015	☑ –		☑ -2.08e+01	1.66e+01
7	NN07	3.01	341	110	EHT	SH	0.035	☐ –		☑ -4.01e+01	1.61e+01
8	NN09	1.78	297	130	EHZ	P	0.024	☑ –		☑ -8.17e-01	2.98e+01
9	NN09	1.78	297	130	EHR	SV	0.010	☑ +		☑ 1.04e+02	1.92e+01
10	NN09	1.78	297	130	EHT	SH	0.048	☐ +		☑ 9.17e+01	2.71e+01
11	NN17	1.31	244	141	EHU	P	-0.015	☑ +		☑ 1.80e+00	1.79e+01
12	NN17	1.31	244	141	EHT	SH	0.021	☑ –		☑ -1.60e+02	1.41e+01
13	NN18	1.56	34	136	EHU	P	-0.009	☑ –		☑ -3.14e+01	1.74e+01
14	NN18	1.56	34	136	EHT	SH	0.037	☐ –		☑ -1.66e+02	1.30e+01
15	NN19	0.97	150	150	EHU	P	0.005	☑ +		☑ 1.38e+01	1.97e+01

	Sta	Type	Penalty
1	NM06	☐ P:SV	
2	NM06	☐ P:SH	
3	NM06	☐ SV:SH	
4	NM22	☑ P:SH	0.007
5	NN07	☐ P:SH	
6	NN09	☐ P:SV	
7	NN09	☐ P:SH	
8	NN09	☐ SV:SH	
9	NN17	☑ P:SH	
10	NN18	☐ P:SH	
11	NN19	☑ P:SV	
12	NN19	☑ P:SH	
13	NN19	☑ SV:SH	
14	NN21	☐ P:SH	
15	NN24	☑ P:SV	0.039

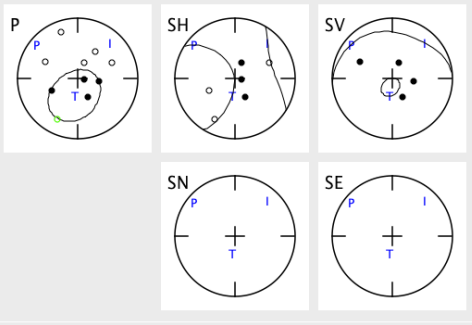
	North	East	Down
North	-1.86e-01	8.58e-02	1.40e-01
East	8.58e-02	-2.76e-01	-1.35e-02
Down	1.40e-01	-1.35e-02	6.01e-02

Scalar M0 = 2.902e-01
T = -0.344 k = -0.341

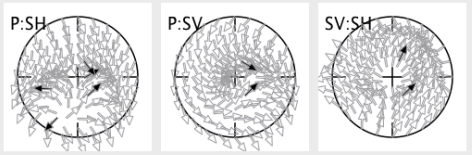
Total Penalty = 0.094



POLARITIES



AMPLITUDE RATIOS



/Users/foulger/SeismicProcessing/Newberry/Data/2014/10/18/20141018235703.or

2014 Oct 18 23:57: 3.695 UTC
Lat: 43.7268 Lon: -121.312 Depth: 0.696
43:43.6104 N 121:18.7104 W

Solve

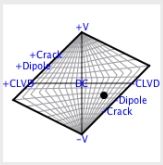
	Sta	Dist	Az	i	Chan	Phase	Resid	Polarity	Penalty	Amp	Freq
1	NM03	2.94	15	115	EHR	SV	0.022	+		4.00e+02	1.81e+01
2	NM22	0.29	128	171	EHR	SV	0.051	+		5.42e+02	1.41e+01
3	NM22	0.29	128	171	EHT	SH	-0.009	+		6.47e+02	1.47e+01
4	NN09	1.81	293	130	EHU	P	0.013	+		2.60e+01	1.82e+01
5	NN09	1.81	293	130	EHR	SV	-0.010	+		2.77e+02	2.25e+01
6	NN09	1.81	293	130	EHT	SH	0.027	+		2.33e+02	2.81e+01
7	NN17	1.43	242	139	EHU	P	-0.012	+	0.005	1.41e+01	2.53e+01
8	NN17	1.43	242	139	EHT	SH	-0.066	+		1.55e+02	1.73e+01
9	NN18	1.43	33	140	EHU	P	0.005	–		-8.25e+01	1.61e+01
10	NN19	1.03	157	150	EHU	P	0.008	+		4.68e+01	1.74e+01
11	NN19	1.03	157	150	EHR	SV	0.071	+		2.04e+02	2.81e+01
12	NN19	1.03	157	150	EHT	SH	-0.007	+		2.67e+02	1.92e+01
13	NN21	1.91	68	130	EHU	P	-0.006	–		-4.32e+01	1.26e+01
14	NN24	0.63	22	161	EHU	P	-0.008	–		-1.03e+02	2.25e+01
15	NN24	0.63	22	161	EHR	SV	-0.039	+		4.53e+02	3.11e+01
16	NN32	2.85	206	113	EHU	P	-0.003	–		-2.30e+01	1.88e+01
17	NN32	2.85	206	113	EHR	SV	0.027	–		-4.56e+02	3.00e+01

	Sta	Type	Penalty
1	NM22	SV:SH	
2	NN09	P:SV	
3	NN09	P:SH	
4	NN09	SV:SH	
5	NN17	P:SH	0.018
6	NN19	P:SV	
7	NN19	P:SH	
8	NN19	SV:SH	0.060
9	NN24	P:SV	0.102
10	NN32	P:SV	
11	NN32	P:SH	
12	NN32	SV:SH	

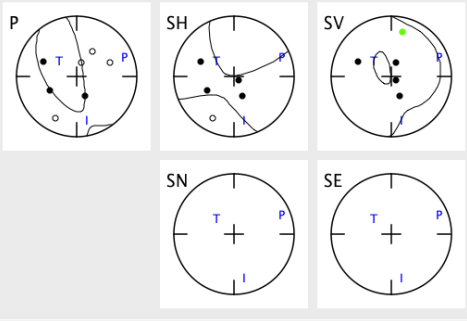
	North	East	Down
North	-4.20e-02	-1.46e-01	-5.38e-04
East	-1.46e-01	-3.20e-01	1.43e-01
Down	-5.38e-04	1.43e-01	5.83e-02

Scalar M0 = 3.091e-01
T = 0.585 k = -0.241

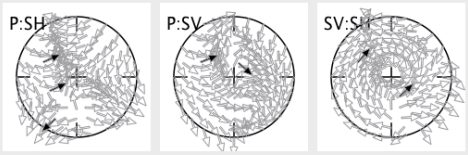
Total Penalty = 0.186



POLARITIES



AMPLITUDE RATIOS



/Users/foulger/SeismicProcessing/Newberry/Data/2014/10/15/20141015153725.or

2014 Oct 15 15:37:25.945 UTC
Lat: 43.7254 Lon: -121.31 Depth: 0.687
43:43.5264 N 121:18.5784 W

Solve

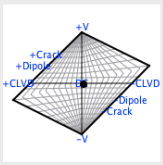
	Sta	Dist	Az	i	Chan	Phase	Resid	Polarity	Penalty	Amp	Freq
1	NM40	2.55	108	121	EHT	SH	0.020	☑ +		☑ 9.44e+01	1.97e+01
2	NM41	2.22	138	125	EHT	SH	-0.043	☑ +		☑ 3.63e+02	1.54e+01
3	NM42	3.72	41	107	EHU	P	0.045	☐ +		☑ 2.73e+02	1.25e+01
4	NN07	3.15	337	110	EHU	P	-0.007	☑ –		☑ -5.18e+01	1.51e+01
5	NN07	3.15	337	110	EHT	SH	0.005	☑ –		☑ -1.25e+02	2.04e+01
6	NN09	2.04	295	125	EHU	P	0.015	☑ +		☑ 4.62e+00	2.08e+01
7	NN09	2.04	295	125	EHR	SV	0.006	☑ +		☑ 2.62e+02	2.45e+01
8	NN09	2.04	295	125	EHT	SH	0.042	☑ +		☑ 1.66e+02	2.52e+01
9	NN17	1.53	250	136	EHU	P	-0.001	☑ +		☑ 1.84e+01	2.44e+01
10	NN17	1.53	250	136	EHR	SV	0.016	☑ +		☑ 4.20e+02	1.48e+01
11	NN17	1.53	250	136	EHT	SH	0.023	☑ –		☑ -4.82e+02	1.55e+01
12	NN18	1.48	24	138	EHU	P	-0.006	☑ –		☑ -6.35e+01	1.61e+01
13	NN18	1.48	24	138	EHR	SV	0.020	☐ –		☑ -5.57e+02	1.21e+01
14	NN19	0.82	165	155	EHU	P	0.012	☑ +		☑ 2.31e+02	1.79e+01
15	NN19	0.82	165	155	EHT	SH	0.073	☑ –		☑ -7.48e+02	1.42e+01

	Sta	Type	Penalty
1	NN07	☐ P:SH	
2	NN09	☑ P:SV	
3	NN09	☑ P:SH	
4	NN09	☑ SV:SH	
5	NN17	☑ P:SV	0.004
6	NN17	☑ P:SH	0.028
7	NN17	☑ SV:SH	0.113
8	NN18	☐ P:SV	
9	NN19	☐ P:SH	
10	NN21	☐ P:SH	
11	NN24	☑ P:SV	
12	NN24	☑ P:SH	
13	NN24	☑ SV:SH	
14	NN32	☑ P:SH	

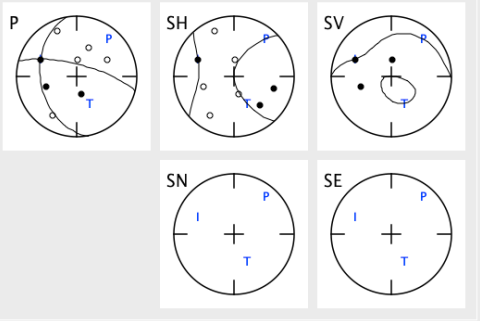
	North	East	Down
North	-5.10e-02	-1.76e-01	1.95e-01
East	-1.76e-01	-8.50e-02	1.28e-03
Down	1.95e-01	1.28e-03	1.20e-01

Scalar M0 = 2.847e-01
T = 0.039 k = -0.019

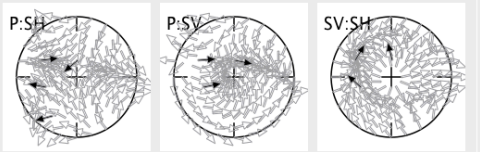
Total Penalty = 0.144



POLARITIES



AMPLITUDE RATIOS



/Users/foulger/SeismicProcessing/Newberry/Data/2014/10/15/20141015150344.or

2014 Oct 15 15: 3:44.602 UTC
Lat: 43.7259 Lon: -121.309 Depth: 0.805
43:43.5528 N 121:18.549 W

Solve

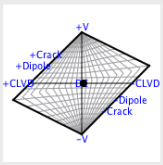
	Sta	Dist	Az	i	Chan	Phase	Resid	Polarity	Penalty	Amp	Freq
1	NN07	3.12	336	113	EHU	P	0.008	☑ –		☑ -2.24e+01	1.64e+01
2	NN07	3.12	336	113	EHR	SV	-0.043	☐ +		☑ 3.53e+01	1.73e+01
3	NN07	3.12	336	113	EHT	SH	0.001	☑ –		☑ -8.42e+01	1.37e+01
4	NN09	2.05	293	128	EHU	P	0.008	☑ –	0.003	☑ -3.05e+00	1.29e+01
5	NN09	2.05	293	128	EHR	SV	-0.023	☑ +	0.052	☑ 1.86e+02	2.18e+01
6	NN09	2.05	293	128	EHT	SH	0.022	☑ +	0.028	☑ 1.12e+02	1.83e+01
7	NN17	1.59	249	138	EHU	P	-0.004	☑ +		☑ 7.75e+00	2.71e+01
8	NN17	1.59	249	138	EHR	SV	0.019	☑ +		☑ 1.09e+02	1.44e+01
9	NN17	1.59	249	138	EHT	SH	0.005	☑ –		☑ -3.49e+02	2.21e+01
10	NN18	1.42	24	142	EHU	P	0.005	☑ –		☑ -4.72e+01	2.20e+01
11	NN18	1.42	24	142	EHR	SV	0.009	☐ –		☑ -5.13e+02	1.33e+01
12	NN19	0.86	168	155	EHU	P	0.009	☑ +		☑ 1.03e+02	1.85e+01
13	NN19	0.86	168	155	EHT	SH	0.049	☑ –		☑ -2.98e+02	1.17e+01
14	NN21	1.75	62	136	EHU	P	-0.002	☑ –		☑ -1.79e+01	1.59e+01
15	NN21	1.75	62	136	EHR	SV	-0.044	☑ +		☑ 1.41e+02	1.07e+01

	Sta	Type	Penalty
1	NN07	☐ P:SV	
2	NN07	☐ P:SH	
3	NN07	☐ SV:SH	
4	NN09	☑ P:SV	
5	NN09	☑ P:SH	
6	NN09	☑ SV:SH	
7	NN17	☑ P:SV	0.027
8	NN17	☑ P:SH	0.003
9	NN17	☐ SV:SH	
10	NN18	☐ P:SV	
11	NN19	☑ P:SH	0.013
12	NN21	☑ P:SV	0.015
13	NN21	☐ P:SH	
14	NN21	☐ SV:SH	
15	NN24	☑ P:SV	

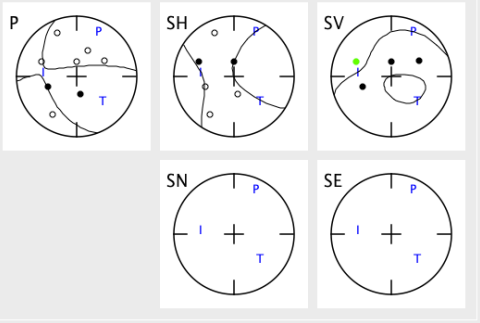
	North	East	Down
North	-1.27e-01	-1.70e-01	1.57e-01
East	-1.70e-01	3.34e-02	-5.42e-02
Down	1.57e-01	-5.42e-02	7.86e-02

Scalar M0 = 2.607e-01
T = 0.055 k = -0.018

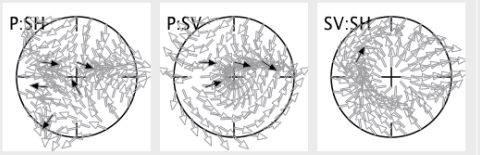
Total Penalty = 0.188



POLARITIES



AMPLITUDE RATIOS



/Users/foulger/SeismicProcessing/Newberry/Data/2014/09/30/20140930092338.or

2014 Sep 30 9:23:48.626 UTC
Lat: 43.7261 Lon: -121.309 Depth: 1.305
43:43.5642 N 121:18.5634 W

Solve

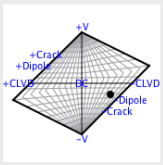
	Sta	Dist	Az	i	Chan	Phase	Resid	Polarity	Penalty	Amp	Freq
1	NM03	2.97	11	127	EHU	P	0.014	☑ –			
2	NM06	0.76	103	163	EHU	P	0.023	☐ +		☑ 1.52e+01	1.70e+01
3	NM06	0.76	103	163	EHR	SV	0.078	☑ +		☑ 8.82e+01	1.32e+01
4	NM06	0.76	103	163	EHT	SH	0.089	☐ –		☑ -7.00e+02	1.20e+01
5	NM22	0.10	159	178	EHR	SV	0.037	☑ +	0.015	☑ 8.17e+02	1.54e+01
6	NM22	0.10	159	178	EHT	SH	0.074	☐ –		☑ -4.81e+02	1.32e+01
7	NM42	3.66	42	120	EHU	P	0.018	☑ –		☑ -1.13e+02	1.47e+01
8	NM42	3.66	42	120	EHT	SH	0.084	☑ –		☑ -3.16e+02	1.61e+01
9	NN07	3.09	336	123	EHU	P	0.013	☑ –		☑ -3.00e+01	1.57e+01
10	NN09	2.03	293	137	EHU	P	0.006	☑ +		☑ 1.49e+01	1.09e+01
11	NN09	2.03	293	137	EHR	SV	-0.013	☑ +		☑ 2.52e+02	2.34e+01
12	NN09	2.03	293	137	EHT	SH	0.025	☑ +		☑ 1.73e+02	3.30e+01
13	NN17	1.58	248	146	EHU	P	-0.001	☑ +		☑ 7.60e+00	2.17e+01
14	NN17	1.58	248	146	EHT	SH	0.024	☑ +	0.036	☑ 2.60e+02	8.34e+00
15	NN18	1.41	25	149	EHU	P	-0.014	☑ –		☑ -2.68e+01	1.61e+01

	Sta	Type	Penalty
1	NM06	☐ P:SV	
2	NM06	☐ P:SH	
3	NM06	☐ SV:SH	
4	NM42	☑ P:SH	
5	NN09	☑ P:SV	
6	NN09	☑ P:SH	
7	NN09	☑ SV:SH	
8	NN17	☑ P:SH	0.035
9	NN18	☐ P:SV	
10	NN19	☐ P:SH	
11	NN24	☑ P:SV	0.058
12	NN24	☐ P:SH	
13	NN24	☐ SV:SH	
14	NN32	☑ P:SV	0.001
15	NN32	☑ P:SH	

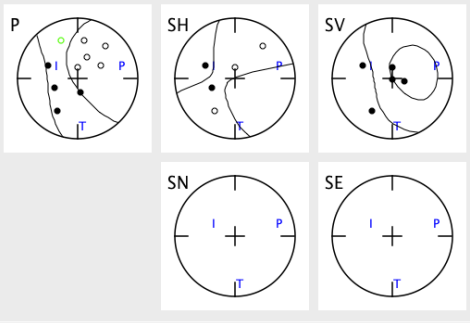
	North	East	Down
North	6.49e-02	-9.50e-02	6.74e-02
East	-9.50e-02	-2.84e-01	1.45e-01
Down	6.74e-02	1.45e-01	-3.58e-02

Scalar M0 = 2.789e-01
T = 0.744 k = -0.223

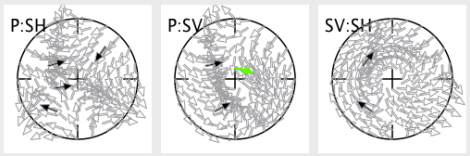
Total Penalty = 0.148



POLARITIES



AMPLITUDE RATIOS



/Users/foulger/SeismicProcessing/Newberry/Data/2014/10/11/20141011032905.or

2014 Oct 11 3:29: 5.667 UTC
Lat: 43.7264 Lon: -121.31 Depth: 0.504
43:43.5846 N 121:18.5856 W

Solve

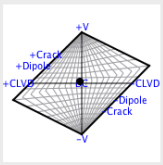
	Sta	Dist	Az	i	Chan	Phase	Resid	Polarity	Penalty	Amp	Freq
1	NM03	2.94	12	108	EHU	P	0.007	–		-1.23e+01	1.01e+01
2	NM22	0.15	153	175	EHU	P	-0.014	+		2.84e+02	1.44e+01
3	NM42	3.65	43	102	EHU	P	-0.024	–		-1.11e+02	1.07e+01
4	NM42	3.65	43	102	EHR	SV	0.120	–	0.007	-2.78e+02	2.42e+01
5	NM42	3.65	43	102	EHT	SH	0.118	+		2.19e+02	1.07e+01
6	NN07	3.05	336	105	EHU	P	-0.007	–		-2.88e+01	1.32e+01
7	NN07	3.05	336	105	EHR	SV	0.027	–		-1.30e+02	2.16e+01
8	NN07	3.05	336	105	EHT	SH	-0.002	–		-1.46e+02	1.33e+01
9	NN09	1.98	292	121	EHU	P	0.011	+	0.002	2.00e+00	2.32e+01
10	NN09	1.98	292	121	EHR	SV	-0.014	+	0.018	1.25e+02	1.09e+01
11	NN09	1.98	292	121	EHT	SH	0.019	+	0.023	1.07e+02	4.00e+01
12	NN17	1.56	246	131	EHU	P	-0.009	+		1.13e+01	3.06e+01
13	NN17	1.56	246	131	EHR	SV	0.035	–		-1.02e+03	1.17e+01
14	NN17	1.56	246	131	EHT	SH	-0.001	–	0.001	-4.62e+02	1.18e+01
15	NN18	1.39	26	136	EHU	P	0.002	–		-6.46e+01	1.58e+01

	Sta	Type	Penalty
1	NM42	P:SV	
2	NM42	P:SH	
3	NM42	SV:SH	
4	NN07	P:SV	0.004
5	NN07	P:SH	
6	NN07	SV:SH	
7	NN09	P:SV	
8	NN09	P:SH	
9	NN09	SV:SH	
10	NN17	P:SV	
11	NN17	P:SH	0.008
12	NN17	SV:SH	
13	NN18	P:SV	
14	NN18	P:SH	
15	NN18	SV:SH	

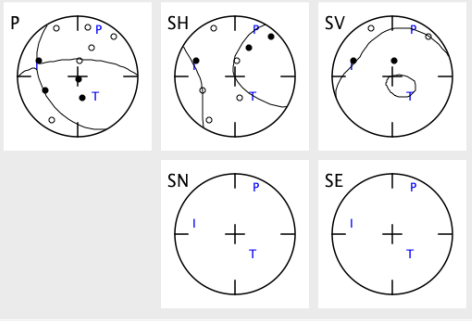
	North	East	Down
North	-1.43e-01	-1.36e-01	1.56e-01
East	-1.36e-01	3.35e-03	-5.83e-02
Down	1.56e-01	-5.83e-02	1.55e-01

Scalar M0 = 2.611e-01
T = -0.033 k = 0.020

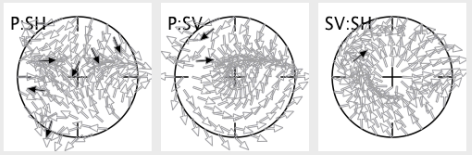
Total Penalty = 0.157



POLARITIES



AMPLITUDE RATIOS



/Users/foulger/SeismicProcessing/Newberry/Data/2014/10/11/20141011105326.or

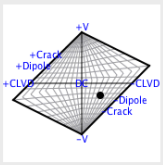
2014 Oct 11 10:53:26.502 UTC
Lat: 43.726 Lon: -121.309 Depth: 0.885
43:43.5606 N 121:18.5628 W

Solve

	North	East	Down
North	3.71e-03	3.87e-02	5.61e-02
East	3.87e-02	-3.57e-01	2.09e-01
Down	5.61e-02	2.09e-01	2.16e-02

Scalar M0 = 3.353e-01
T = 0.489 k = -0.246

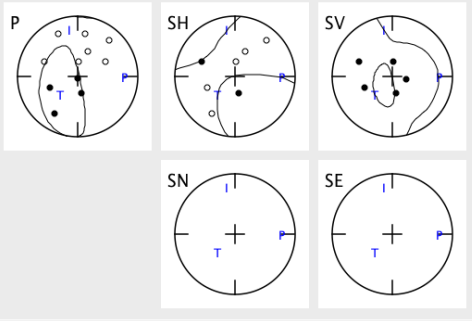
Total Penalty = 0.191



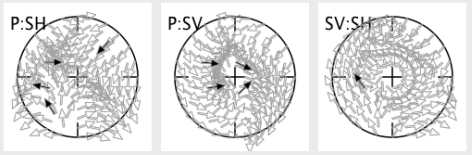
	Sta	Dist	Az	i	Chan	Phase	Resid	Polarity	Penalty	Amp	Freq
1	NM03	2.98	11	119	EHU	P	-0.001	–		-5.63e+00	2.29e+01
2	NM06	0.76	102	160	EHU	P	0.015	+		1.05e+02	1.49e+01
3	NM06	0.76	102	160	EHR	SV	0.091	+		3.24e+02	2.31e+01
4	NM06	0.76	102	160	EHT	SH	0.134	–		-1.07e+03	1.56e+01
5	NM22	0.09	158	177	EHU	P	-0.014	+		8.72e+01	1.74e+01
6	NM41	2.25	139	129	EHT	SH	0.067	–		-3.24e+02	1.04e+01
7	NM42	3.66	42	112	EHU	P	0.014	–		-8.38e+01	1.29e+01
8	NM42	3.66	42	112	EHT	SH	0.140	–		-3.74e+02	1.01e+01
9	NN07	3.10	336	115	EHU	P	0.014	–		-2.11e+01	1.59e+01
10	NN09	2.03	293	130	EHU	P	0.012	–		-3.56e+00	2.39e+01
11	NN09	2.03	293	130	EHR	SV	-0.008	+		1.47e+02	1.92e+01
12	NN09	2.03	293	130	EHT	SH	0.032	+	0.007	1.44e+03	6.37e+01
13	NN17	1.57	248	139	EHU	P	-0.002	+		6.63e+00	2.63e+01
14	NN17	1.57	248	139	EHR	SV	0.005	+		2.03e+02	1.92e+01
15	NN17	1.57	248	139	EHT	SH	-0.001	–		-1.55e+02	1.69e+01

	Sta	Type	Penalty
1	NM06	P:SV	
2	NM06	P:SH	
3	NM06	SV:SH	
4	NM42	P:SH	0.001
5	NN09	P:SV	0.005
6	NN09	P:SH	0.017
7	NN09	SV:SH	
8	NN17	P:SV	0.087
9	NN17	P:SH	0.088
10	NN17	SV:SH	0.004
11	NN18	P:SH	
12	NN19	P:SV	0.004
13	NN19	P:SH	
14	NN19	SV:SH	
15	NN24	P:SV	0.006

POLARITIES



AMPLITUDE RATIOS



/Users/foulger/SeismicProcessing/Newberry/Data/2014/10/07/20141007104711.or

2014 Oct 7 10:47:20.916 UTC
Lat: 43.7253 Lon: -121.308 Depth: 1.273
43:43.515 N 121:18.5028 W

Solve

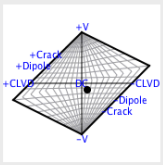
	Sta	Dist	Az	i	Chan	Phase	Resid	Polarity	Penalty	Amp	Freq
1	NM03	3.05	9	125	EHU	P	0.026	☑ +		☑ 1.46e+01	1.95e+01
2	NM03	3.05	9	125	EHR	SV	0.008	☑ –		☑ -2.05e+02	1.71e+01
3	NM06	0.67	97	165	EHR	SV	0.137	☐ –		☑ -4.85e+02	1.41e+01
4	NM06	0.67	97	165	EHT	SH	0.114	☑ –		☑ -8.66e+02	1.21e+01
5	NM22	0.05	267	179	EHR	SV	0.056	☐ +		☑ 9.44e+02	1.14e+01
6	NM22	0.05	267	179	EHT	SH	0.038	☐ +		☑ 3.60e+02	1.21e+01
7	NM41	2.14	140	138	EHT	SH	0.085	☐ –		☑ -3.15e+02	1.44e+01
8	NM42	3.67	40	119	EHU	P	0.011	☐ –		☑ -7.51e+01	1.48e+01
9	NM42	3.67	40	119	EHR	SV	0.088	☐ +		☑ 4.70e+02	1.45e+01
10	NM42	3.67	40	119	EHT	SH	0.096	☑ –		☑ -4.70e+02	1.16e+01
11	NN07	3.21	335	122	EHZ	P	0.002	☑ –		☑ -2.81e+01	1.73e+01
12	NN09	2.14	294	135	EHU	P	0.018	☑ –		☑ -6.41e+00	2.00e+01
13	NN09	2.14	294	135	EHR	SV	-0.018	☑ +		☑ 1.32e+02	2.55e+01
14	NN09	2.14	294	135	EHT	SH	0.022	☐ +		☑ 9.64e+01	3.01e+01
15	NN17	1.62	252	144	EHU	P	-0.002	☑ +		☑ 4.90e+00	2.15e+01

	Sta	Type	Penalty
1	NM03	☑ P:SV	
2	NM06	☐ SV:SH	
3	NM42	☑ P:SV	0.020
4	NM42	☐ P:SH	
5	NM42	☐ SV:SH	
6	NN09	☑ P:SV	0.059
7	NN09	☐ P:SH	
8	NN09	☐ SV:SH	
9	NN17	☑ P:SH	0.062
10	NN18	☑ P:SV	0.039
11	NN19	☑ P:SV	
12	NN21	☑ P:SH	0.001
13	NN24	☑ P:SV	
14	NN24	☑ P:SH	
15	NN24	☑ SV:SH	

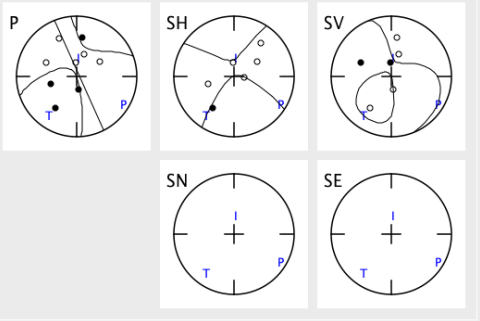
	North	East	Down
North	4.38e-02	2.44e-01	4.36e-02
East	2.44e-01	-1.80e-01	9.99e-02
Down	4.36e-02	9.99e-02	-2.18e-05

Scalar M0 = 2.980e-01
T = 0.137 k = -0.131

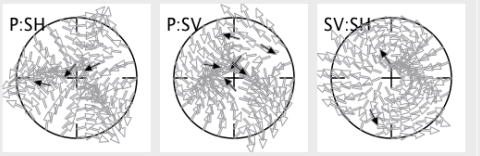
Total Penalty = 0.182



POLARITIES



AMPLITUDE RATIOS



/Users/foulger/SeismicProcessing/Newberry/Data/2014/10/09/20141009062433.or

2014 Oct 9 6:24:33.418 UTC
Lat: 43.7271 Lon: -121.309 Depth: 0.688
43:43.6272 N 121:18.555 W

Solve

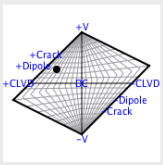
	Sta	Dist	Az	i	Chan	Phase	Resid	Polarity	Penalty	Amp	Freq
1	NM22	0.21	173	174	EHU	P	-0.010	☑ +		☑ 3.68e+02	1.44e+01
2	NM42	3.56	43	108	EHR	SV	0.030	☐ –		☑ -1.86e+02	1.42e+01
3	NM42	3.56	43	108	EHT	SH	0.069	☑ –		☑ -5.08e+02	8.09e+00
4	NN07	2.99	335	112	EHU	P	0.001	☑ –	0.018	☑ -3.21e+01	1.69e+01
5	NN07	2.99	335	112	EHT	SH	0.028	☑ +		☑ 7.83e+01	2.37e+01
6	NN09	1.99	290	126	EHU	P	0.004	☑ –		☑ -2.29e+01	1.79e+01
7	NN09	1.99	290	126	EHR	SV	0.000	☑ +		☑ 3.15e+02	1.08e+01
8	NN09	1.99	290	126	EHT	SH	0.033	☑ +		☑ 9.64e+01	2.25e+01
9	NN17	1.63	244	134	EHU	P	-0.003	☑ +	0.011	☑ 3.73e+00	2.71e+01
10	NN17	1.63	244	134	EHT	SH	0.025	☑ –		☑ -2.10e+02	2.02e+01
11	NN18	1.30	26	143	EHU	P	0.006	☑ +		☑ 5.94e+01	1.78e+01
12	NN18	1.30	26	143	EHR	SV	0.022	☐ –		☑ -5.91e+02	1.29e+01
13	NN19	1.00	169	150	EHU	P	0.019	☑ +		☑ 6.67e+01	2.03e+01
14	NN19	1.00	169	150	EHR	SV	-0.015	☑ +		☑ 5.19e+02	1.86e+01
15	NN21	1.70	67	134	EHU	P	-0.012	☑ +		☑ 2.85e+01	1.54e+01

	Sta	Type	Penalty
1	NM42	☐ SV:SH	
2	NN07	☐ P:SH	
3	NN09	☑ P:SV	
4	NN09	☑ P:SH	
5	NN09	☑ SV:SH	
6	NN17	☑ P:SH	0.015
7	NN18	☐ P:SV	
8	NN19	☑ P:SV	0.091
9	NN21	☐ P:SV	
10	NN24	☐ P:SV	
11	NN24	☑ P:SH	0.009
12	NN24	☐ SV:SH	
13	NN32	☑ P:SV	
14	NN32	☑ P:SH	0.001
15	NN32	☑ SV:SH	0.017

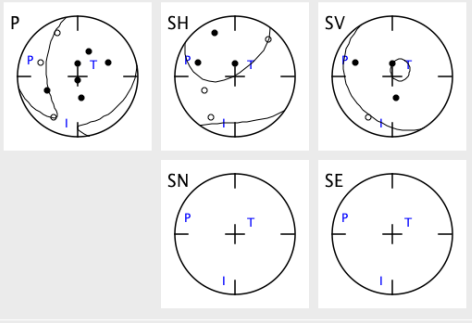
	North	East	Down
North	2.44e-02	7.10e-02	-8.64e-02
East	7.10e-02	-2.43e-02	-1.62e-01
Down	-8.64e-02	-1.62e-01	3.13e-01

Scalar M0 = 2.970e-01
T = -0.650 k = 0.256

Total Penalty = 0.162



POLARITIES



AMPLITUDE RATIOS