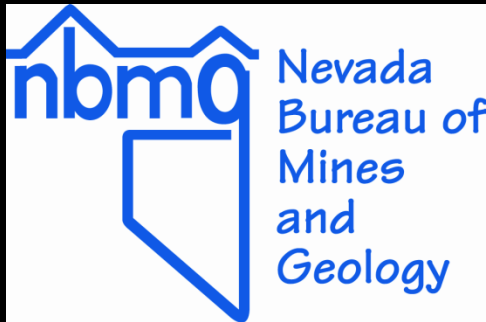
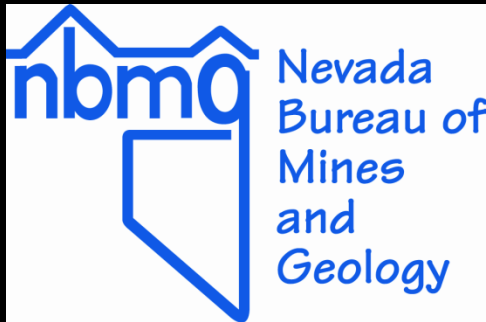


Earthquake Hazards in Lincoln County

**Presentation for the Nevada Hazard Mitigation Planning Committee
by Jonathan G. Price
Nevada Bureau of Mines and Geology**

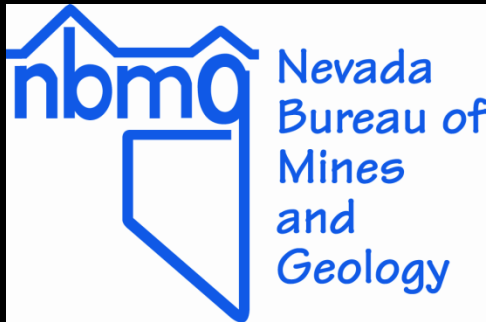


**Earthquake faults occur throughout Nevada,
and potential losses from earthquakes are high
for many communities.**



**Earthquake faults occur throughout Nevada,
and potential losses from earthquakes are high
for many communities.**

**NBMG Map 167, *Quaternary Faults in Nevada*, is now
available not only as a poster but also as an interactive
map (Open-File Report 09-9) on line at
www.nbm.unr.edu. You can use it to locate your home
or business.**



Look for a fault | Find Address

Results

Map Contents

- ☒ Quaternary
- ☐ Legend
- ☐ Base
- ☒ 9i10glj_TC
- ☐ Base
- ☒ USGS_aer
- ☒ Bas

Find Address

Street or Intersection:

City:

State:

ZIP:



Look for a fault | Find Address

Results

- ☒ **100 Front Street, Caliente, Neva**
- ☒ 100 Front St, Caliente, NV, 89008

Map Contents

- ☒ Quaternary_Faults
 - ☐ Legend
 - ☐ Base Data
- ☒ 9i10glj_TOPO_data
 - ☐ Base Data
- ☒ USGS_aerial_photographs
 - ☒ Base Data





Look for a fault | Find Address

Results

☒ 100 Front Street, Caliente

☒ 100 Front St, Caliente

 Zoom to











 Pan to


 Remove

Map Contents

☒ Quaternary_Faults

Legend

-  Historic - within the
-  Historic - within the
-  latest Pleistocene &
-  latest Pleistocene &
-  late Quaternary - w
-  late Quaternary - w
-  middle Quaternary
-  middle Quaternary
-  Quaternary - within
-  Quaternary - within

 Base Data

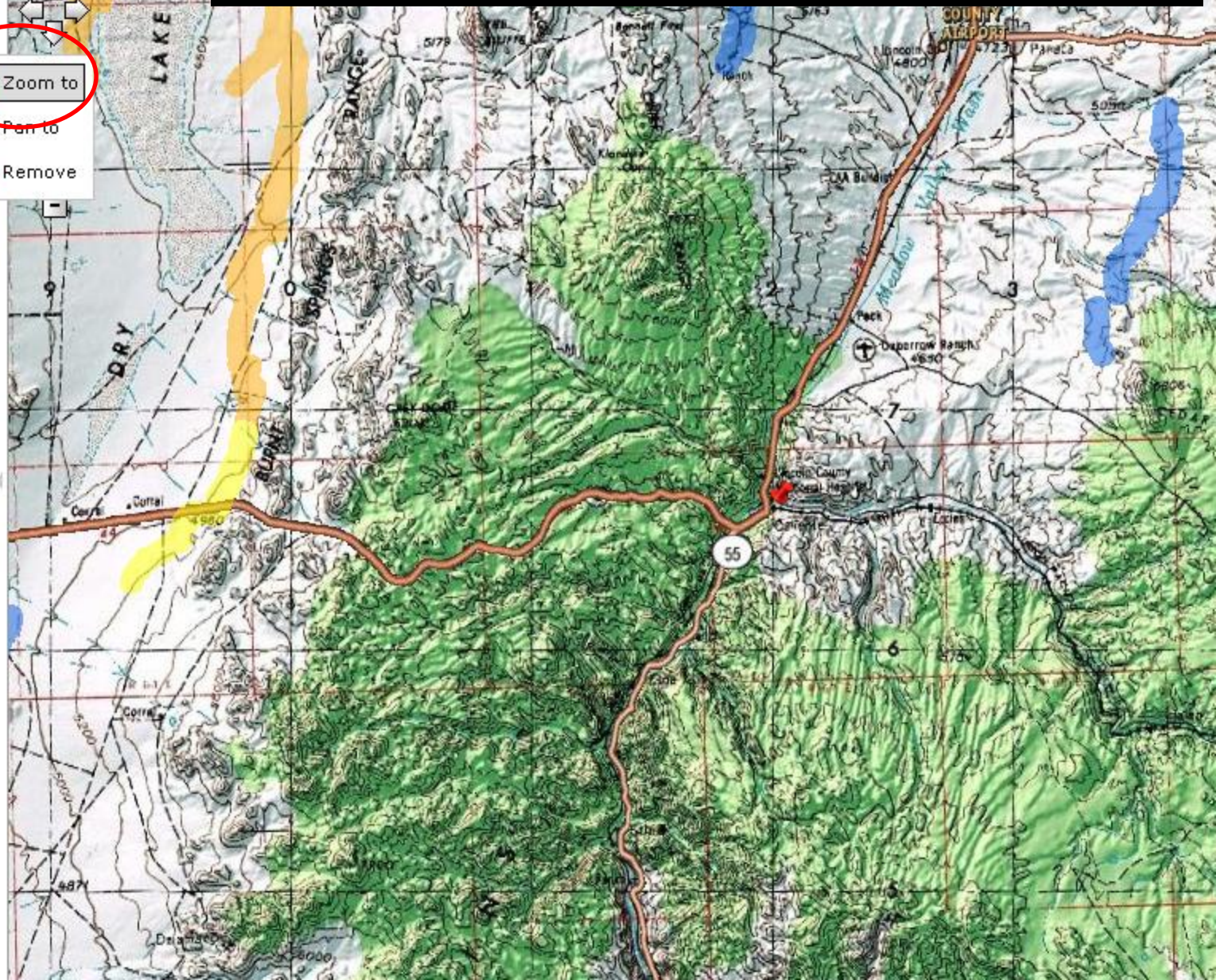
☒ 9i10glj_TOPO_data

 Base Data

☒ USGS_aerial_photographs

 ☒ Base Data

Display faults, colored by age of most recent movement, on topographic or aerial photographic base maps.



Look for a fault | Find Address

Results

- ☒ 100 Front Street, Calie
- ☒ 100 Front St, Caliente

Map Contents

- ☒ Quaternary_Faults

Legend

- ☒ Historic - within the
- ☒ Historic - within the
- ☒ latest Pleistocene &
- ☒ latest Pleistocene &
- ☒ late Quaternary - w
- ☒ late Quaternary - w
- ☒ middle Quaternary
- ☒ middle Quaternary
- ☒ Quaternary - within
- ☒ Quaternary - within

Base Data

- ☐ 9i10glj_TOPO_data

Base Data

- ☒ USGS_aerial_photographs

Base Data

Display faults, colored by age of most recent movement, on topographic or aerial photographic base maps.



Look for a fault | Find Address

Zoom in for more detail.

Results

- ☒ 100 Front Street, Calie
- ☒ 100 Front St, Caliente

Map Contents

- ☒ Quaternary_Faults

Legend

- ☒ Historic - within the
- ☒ Historic - within the
- ☒ latest Pleistocene &
- ☒ latest Pleistocene &
- ☒ late Quaternary - w
- ☒ late Quaternary - w
- ☒ middle Quaternary
- ☒ middle Quaternary
- ☒ Quaternary - within
- ☒ Quaternary - within

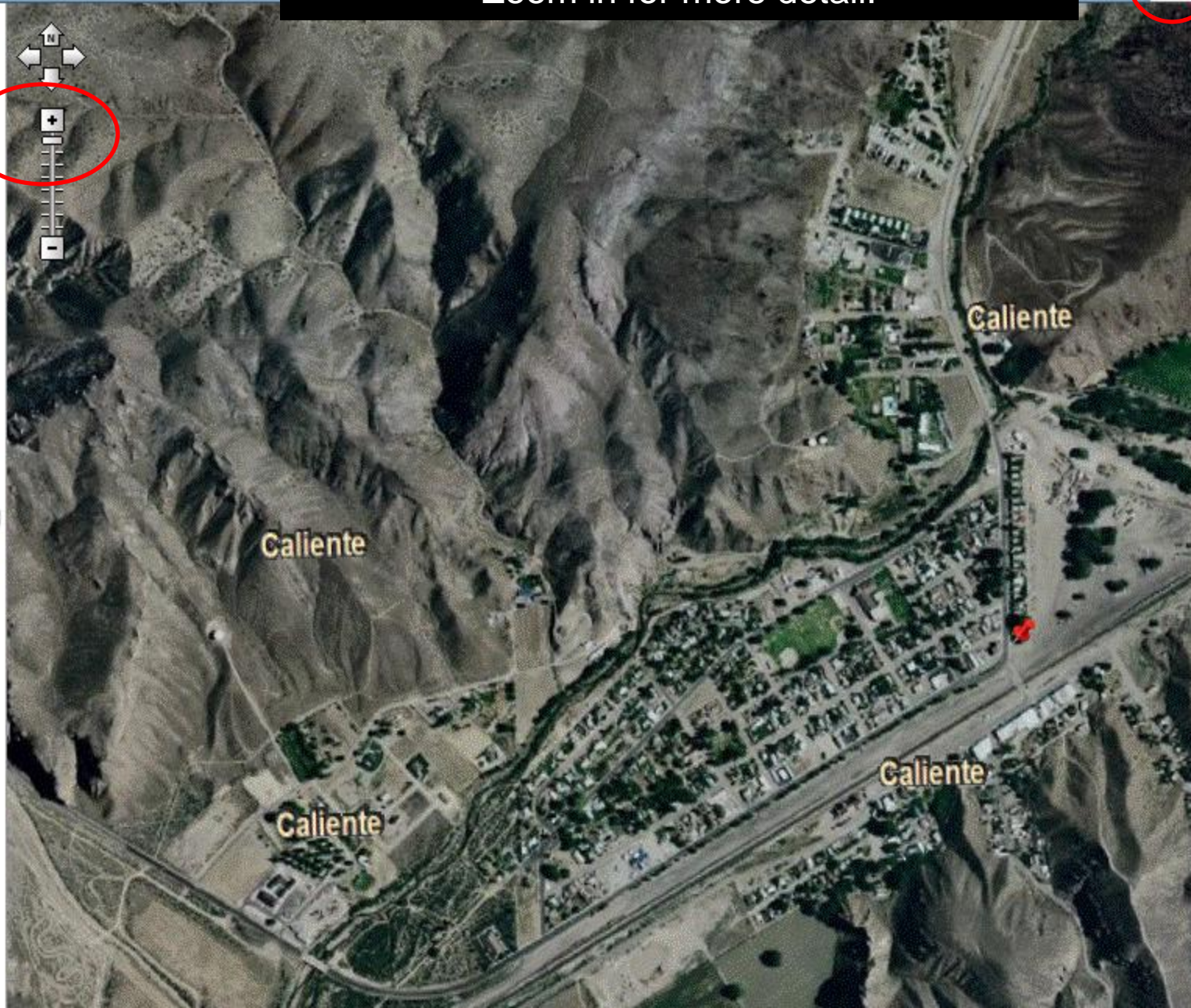
Base Data

- ☐ 9i10glj_TOPO_data

Base Data

- ☒ USGS_aerial_photographs

Base Data



Look for a fault | Find Address

Zoom out for the regional view.

Results

- ☒ 100 Front Street, Calie
- ☒ 100 Front St, Caliente

Map Contents

- ☒ Quaternary_Faults

Legend

- ☒ Historic - within the
- ☒ Historic - within the
- ☒ latest Pleistocene &
- ☒ latest Pleistocene &
- ☒ late Quaternary - w
- ☒ late Quaternary - w
- ☒ middle Quaternary
- ☒ middle Quaternary
- ☒ Quaternary - within
- ☒ Quaternary - within

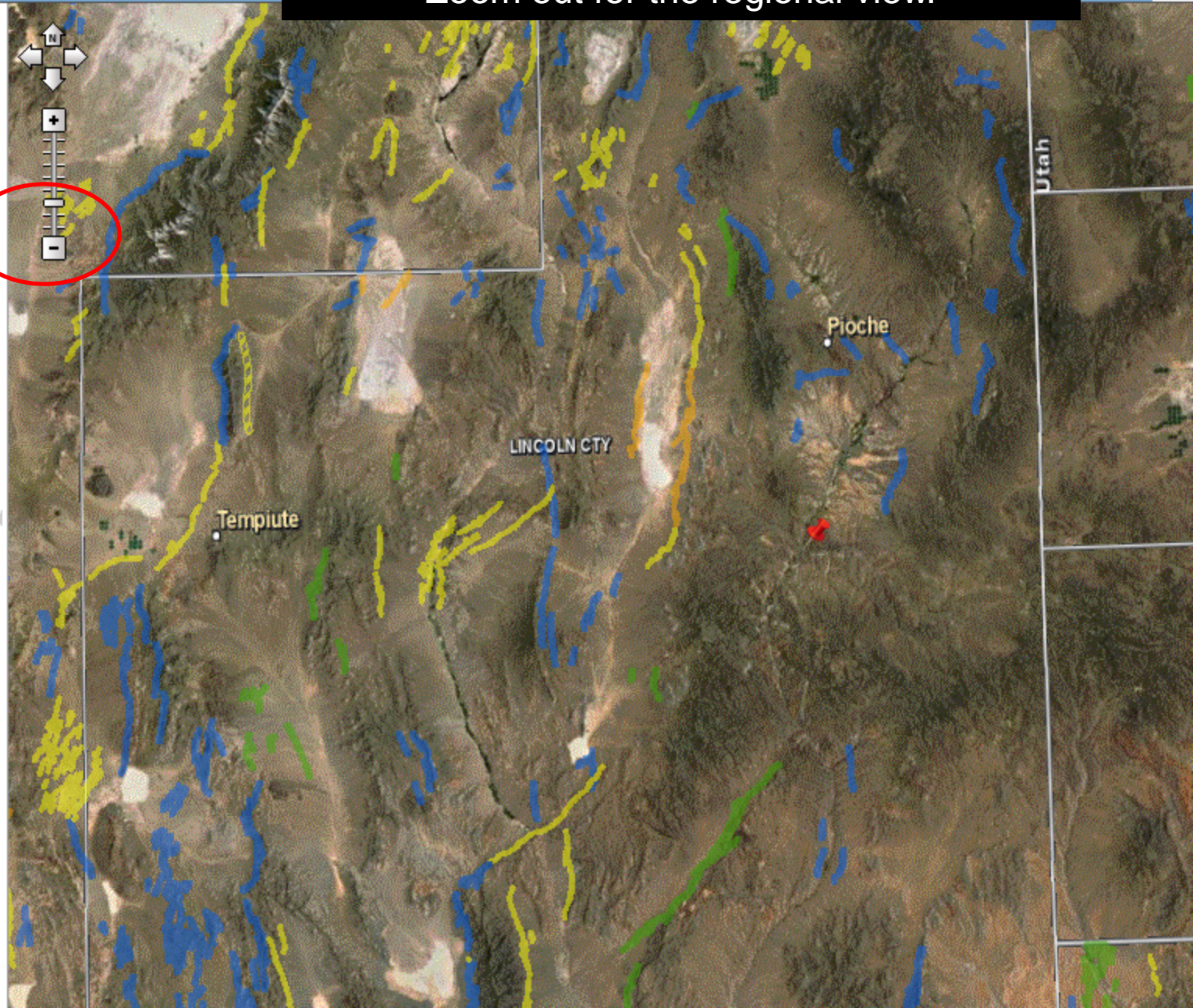
Base Data

- ☐ 9i10glj_TOPO_data

Base Data

- ☒ USGS_aerial_photographs

Base Data



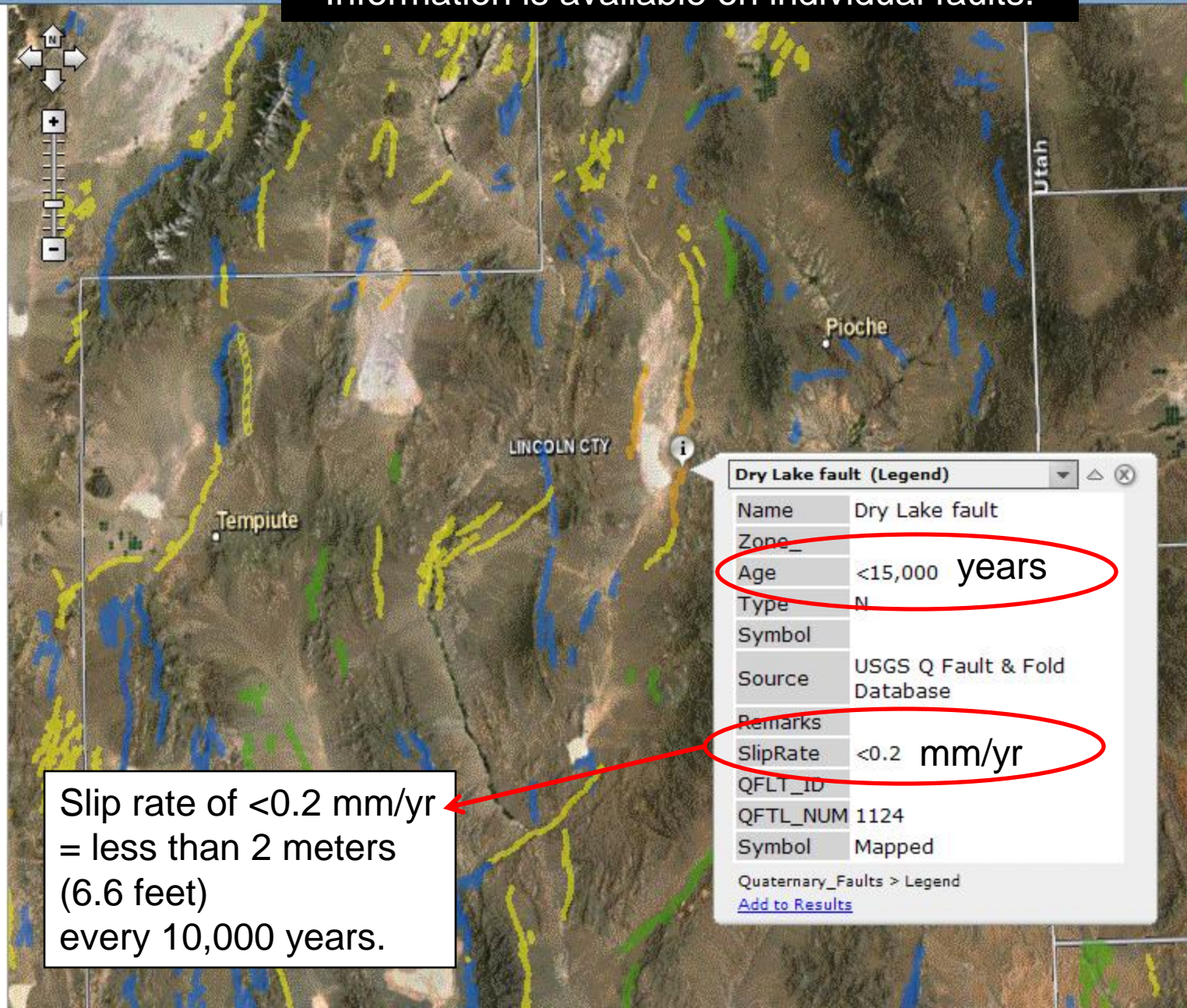
Information is available on individual faults.

Results

- ☒ 100 Front Street, Calie
- ☒ 100 Front St, Caliente

Map Contents

- ☒ Quaternary_Faults
 - Legend**
 - Historic - within the
 - Historic - within the
 - latest Pleistocene &
 - latest Pleistocene &
 - late Quaternary - w
 - late Quaternary - w
 - middle Quaternary
 - middle Quaternary
 - Quaternary - within
 - Quaternary - within
 - Base Data
- ☐ 9i10glj_TOPO_data
 - Base Data
- ☒ USGS_aerial_photographs
 - Base Data

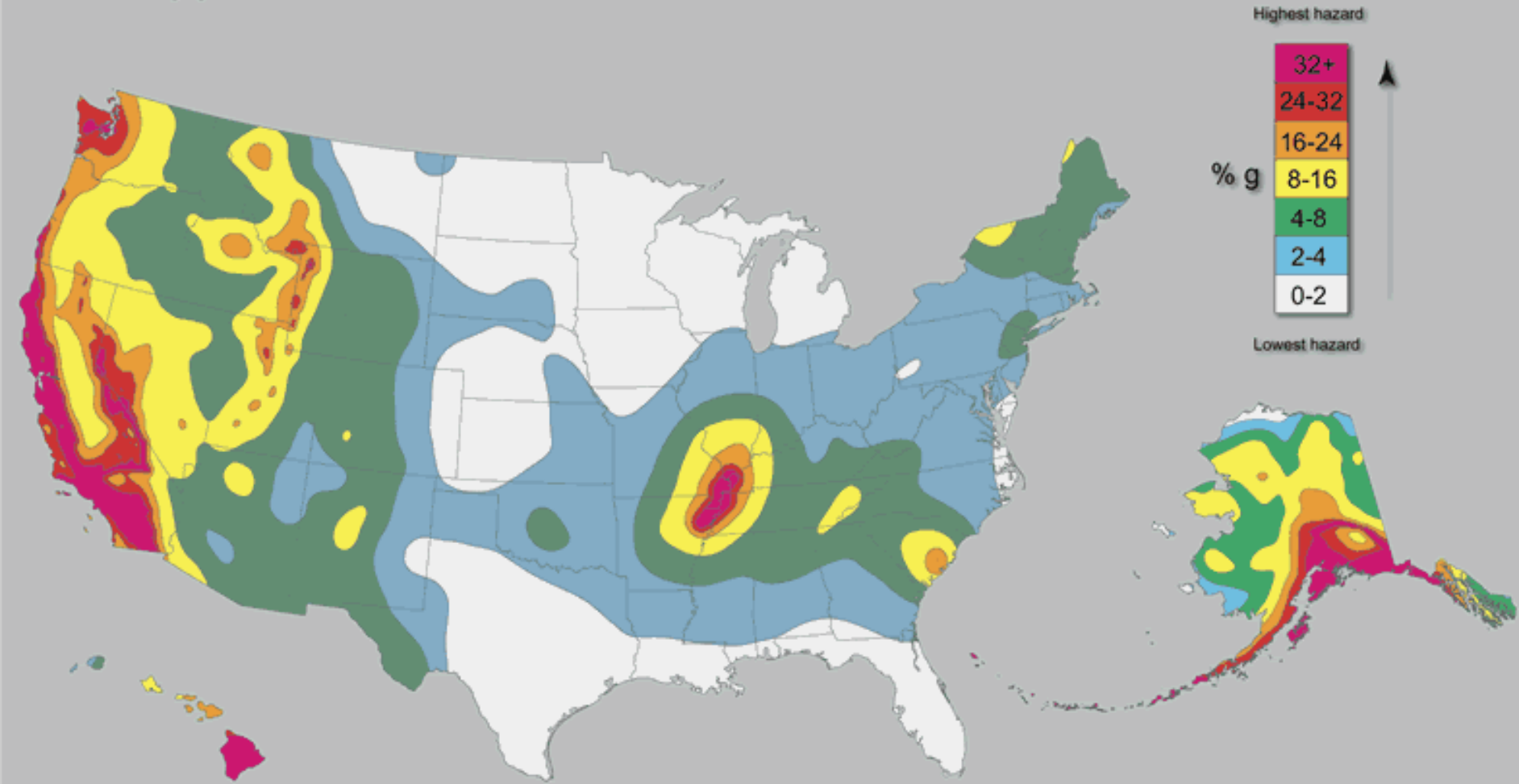


Dry Lake fault (Legend)

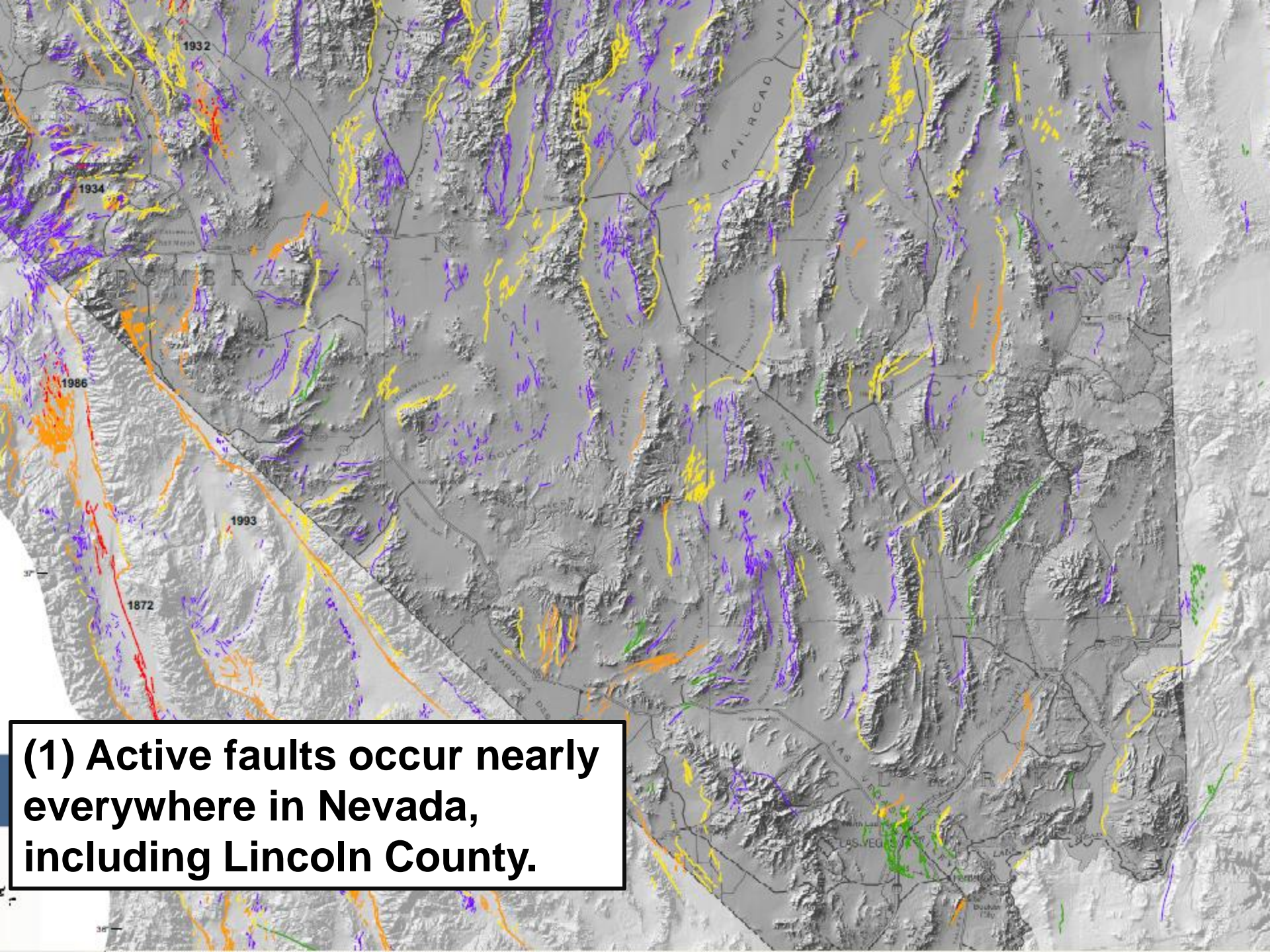
Name	Dry Lake fault
Zone_	
Age	<15,000 years
Type	N
Symbol	
Source	USGS Q Fault & Fold Database
Remarks	
SlipRate	<0.2 mm/yr
QFLT_ID	
QFTL_NUM	1124
Symbol	Mapped

Quaternary_Faults > Legend
[Add to Results](#)

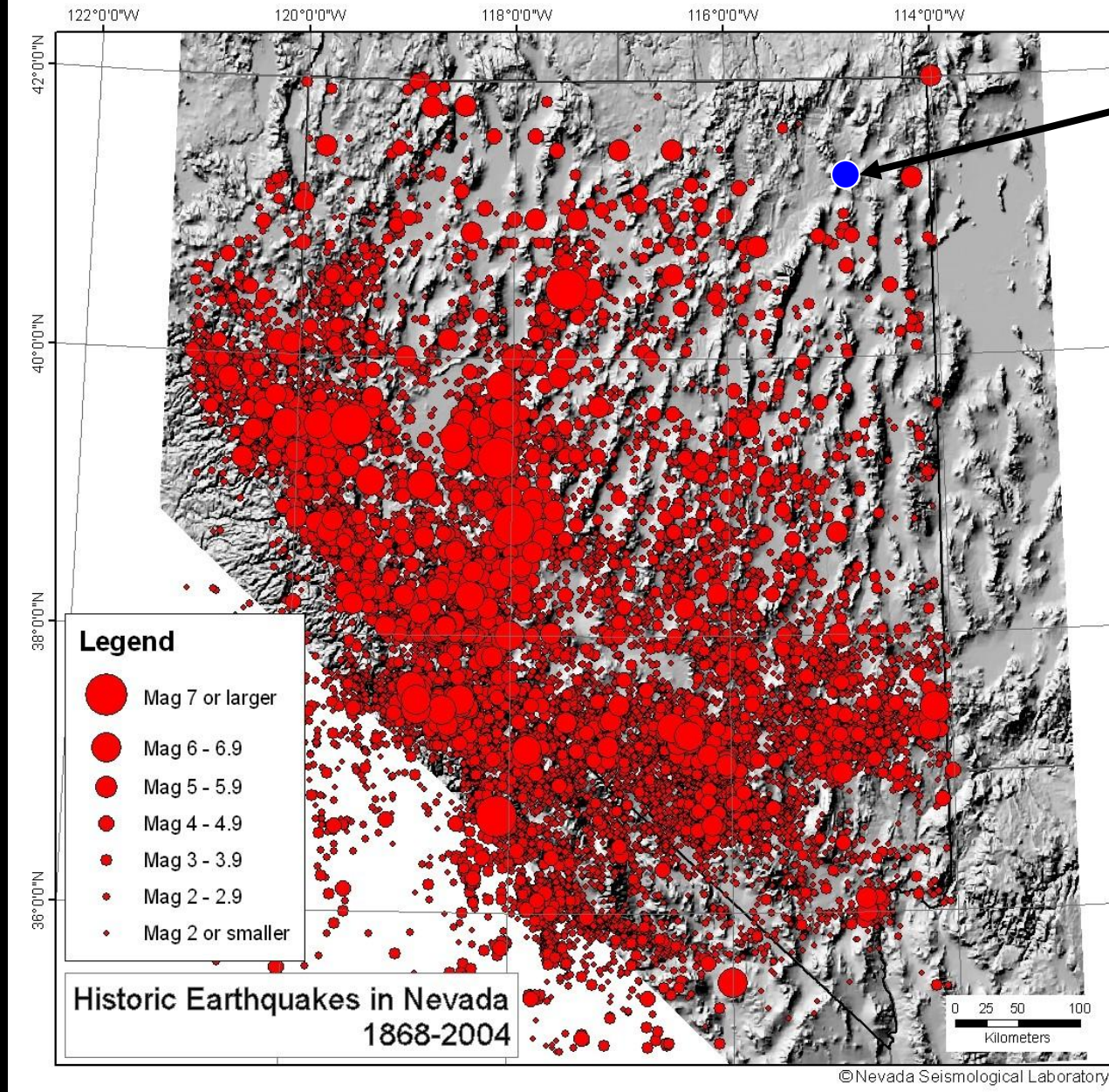
Slip rate of <0.2 mm/yr
 = less than 2 meters
 (6.6 feet)
 every 10,000 years.



The USGS integrates (1) fault, (2) earthquake, and (3) geodetic data into its probabilistic seismic hazard analysis.



(1) Active faults occur nearly everywhere in Nevada, including Lincoln County.



Wells
21 Feb 08
M = 6.0

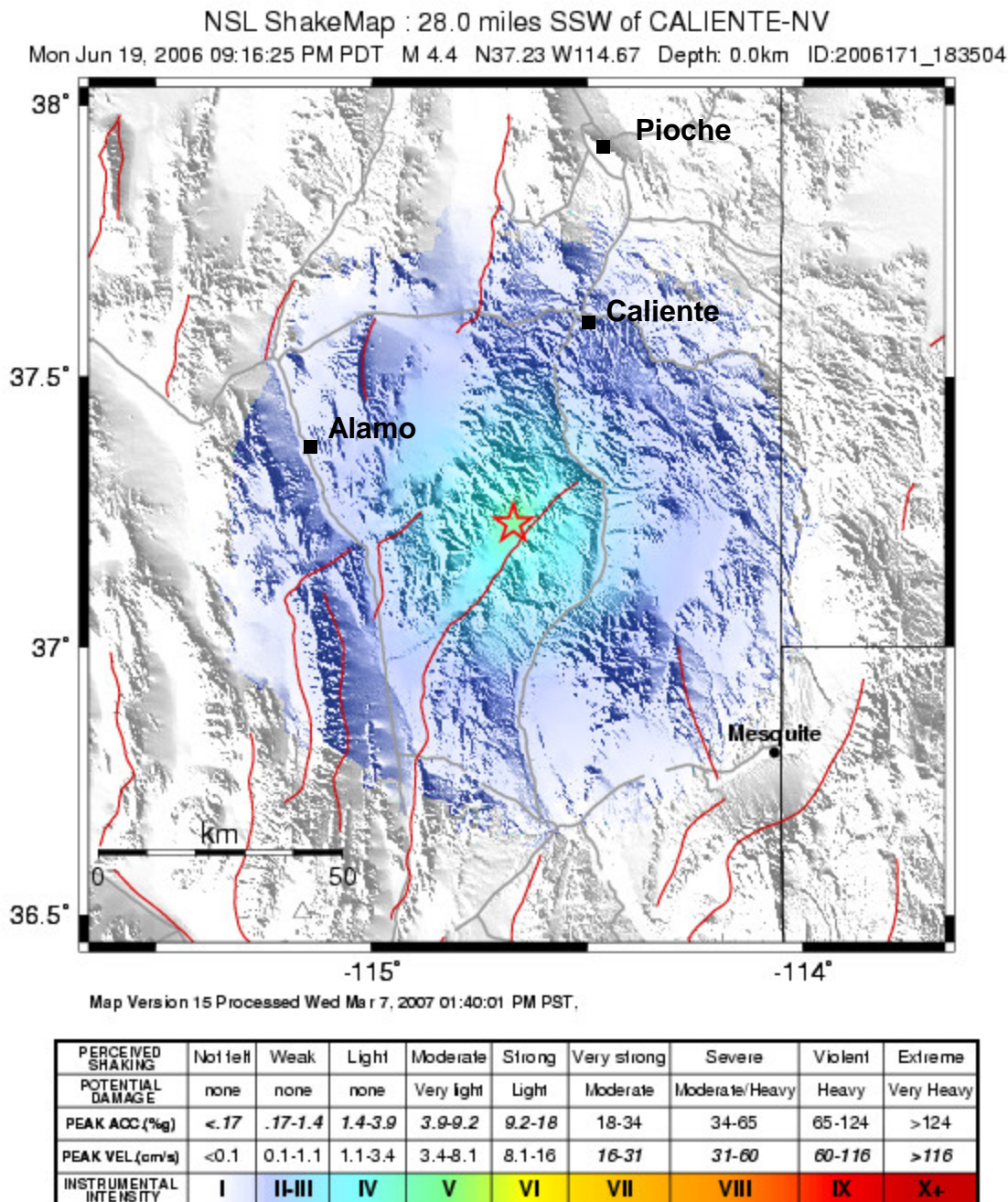
(2) Earthquakes have occurred throughout Nevada.

ShakeMap from the Nevada Seismological Laboratory at UNR

**Magnitude 4.4
28 miles SSW of Caliente
on June 19, 2006**

The earthquake was not obviously on a mapped fault.

A magnitude 6.0 earthquake can occur anywhere in Nevada, on a fault that is not exposed at the Earth's surface.

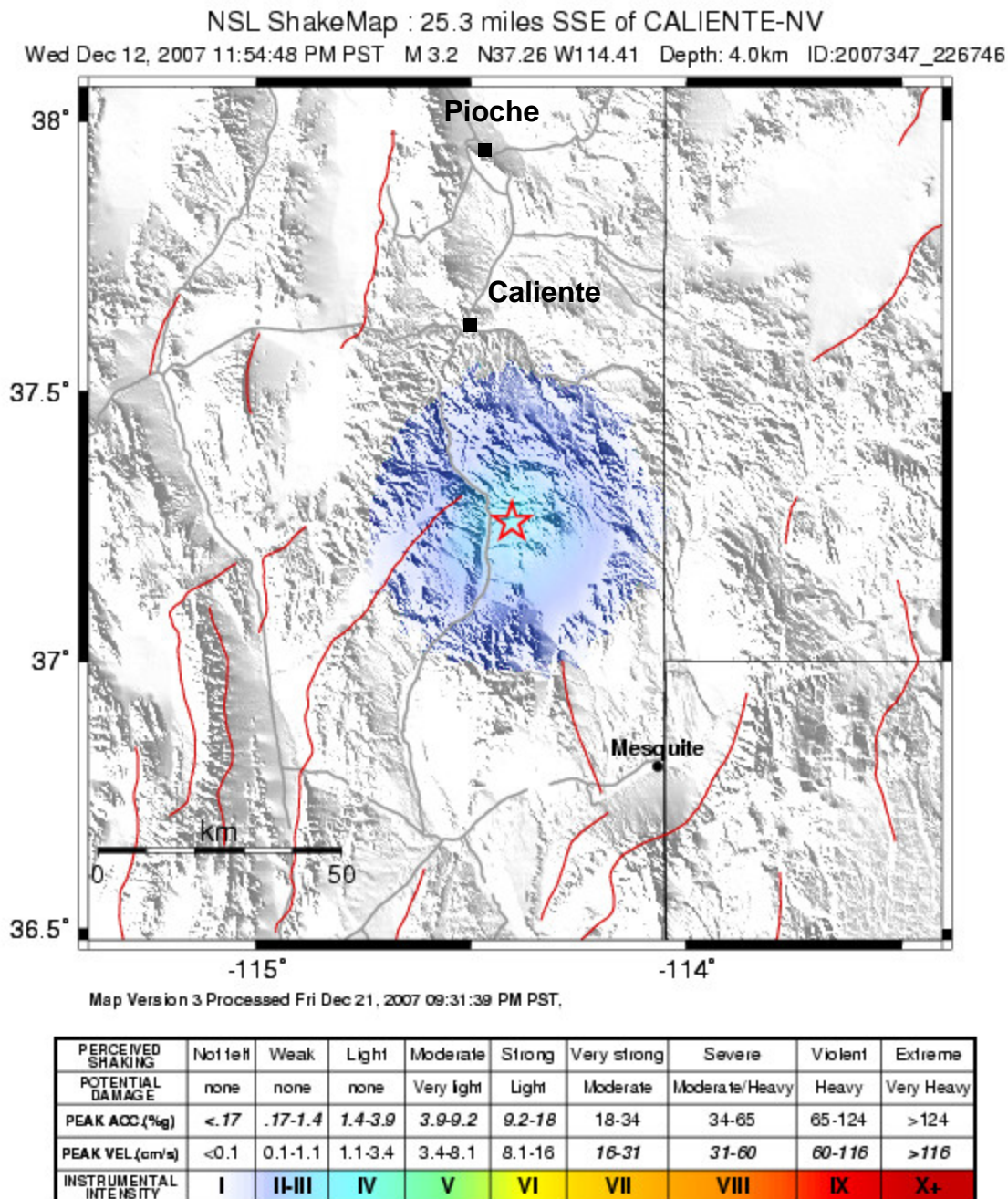


ShakeMap from the Nevada Seismological Laboratory at UNR

**Magnitude 3.2
25 miles SSE of Caliente
on Dec. 12, 2007**

The earthquake was not obviously on a mapped fault.

A magnitude 6.0 earthquake can occur anywhere in Nevada, on a fault that is not exposed at the Earth's surface.

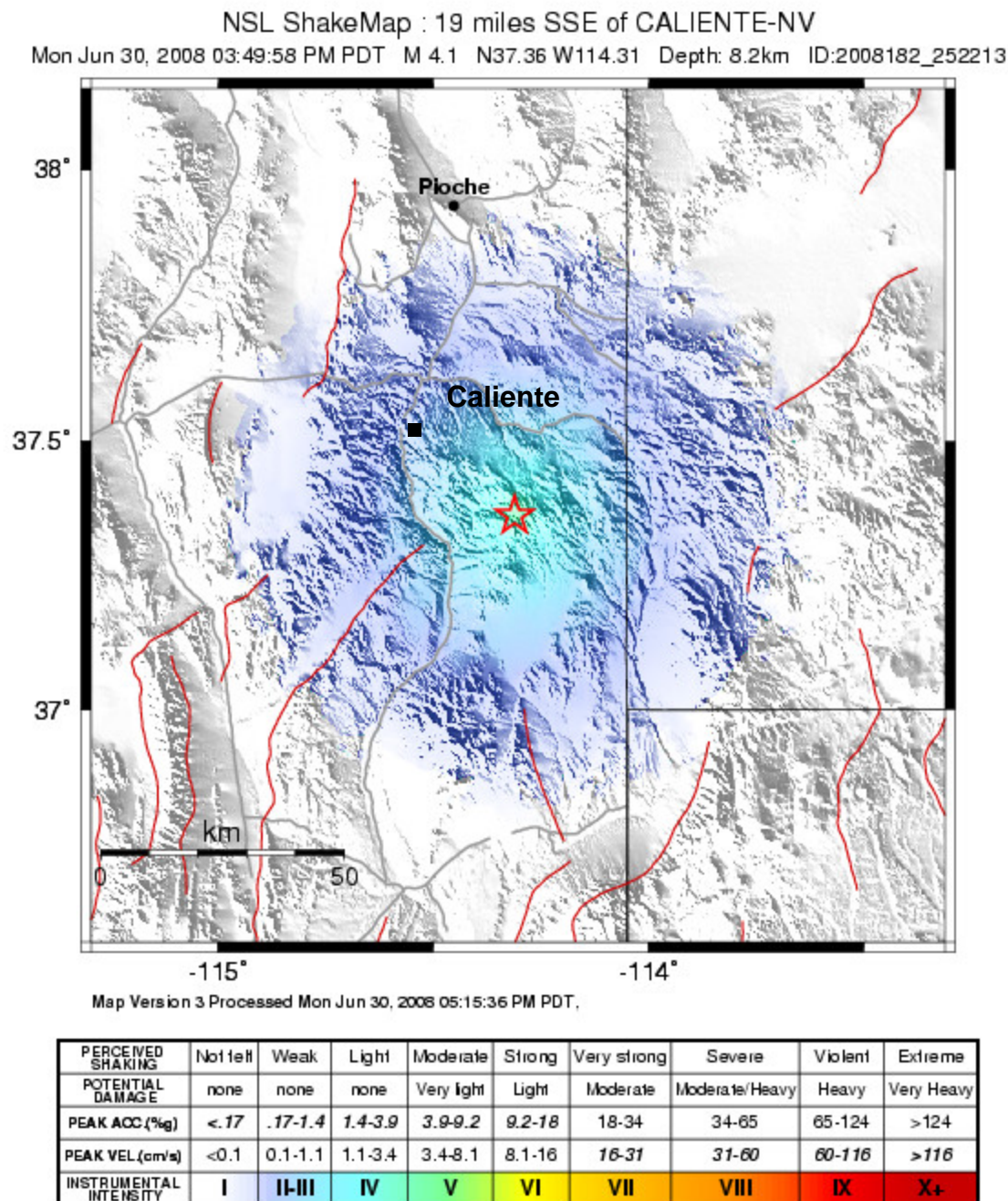


ShakeMap from the Nevada Seismological Laboratory at UNR

**Magnitude 4.1
19 miles SSE of
Caliente
on June 30, 2008**

**The earthquake
was not obviously
on a mapped fault.**

**A magnitude 6.0
earthquake can
occur anywhere in
Nevada, on a fault
that is not exposed
at the Earth's
surface.**



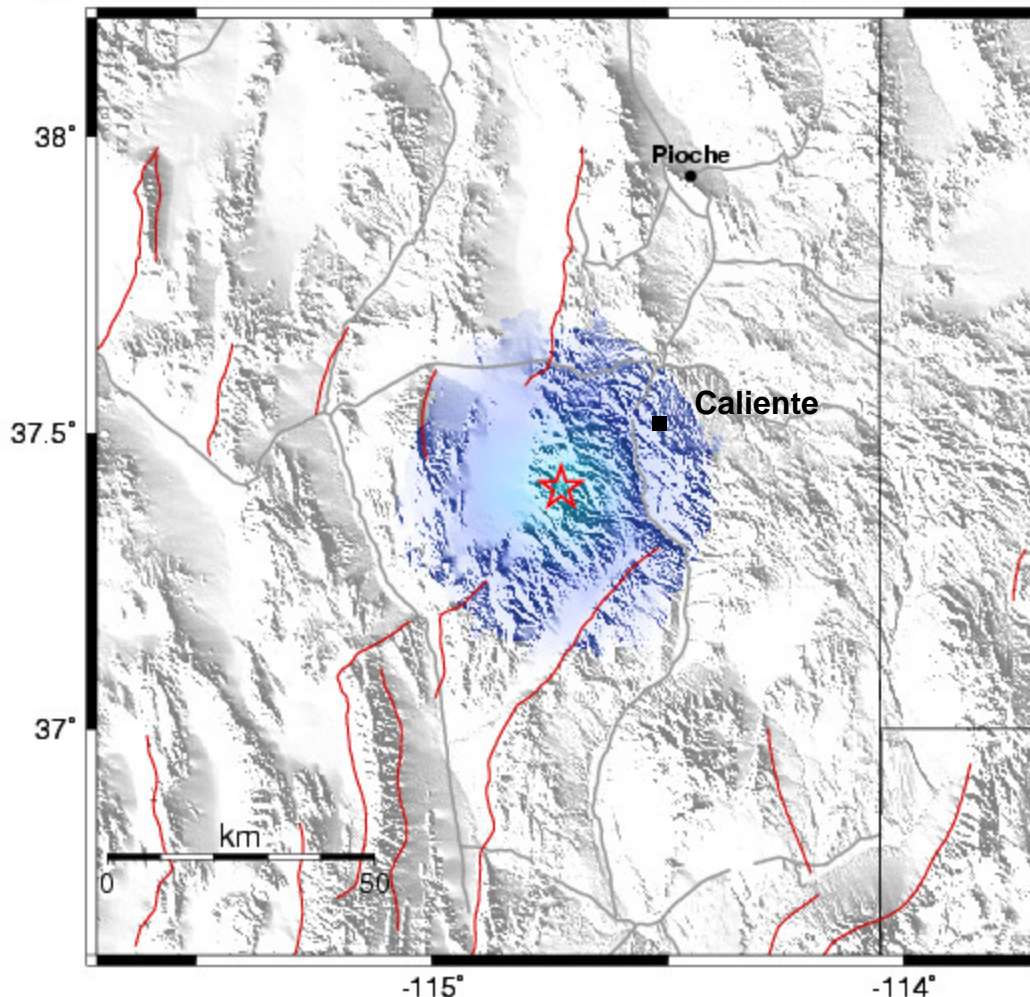
ShakeMap from the Nevada Seismological Laboratory at UNR

**Magnitude 3.2
18 miles SW of
Caliente
on July 19, 2009**

**The earthquake
was not obviously
on a mapped fault.**

**A magnitude 6.0
earthquake can
occur anywhere in
Nevada, on a fault
that is not exposed
at the Earth's
surface.**

NSL ShakeMap : 18.4 miles SW of CALIENTE-NV
Sun Jul 19, 2009 10:31:50 PM PDT M 3.2 N37.41 W114.73 Depth: 0.0km ID:2009201_288313



Map Version 1 Processed Sun Jul 19, 2009 10:47:28 PM PDT, -- NOT REVIEWED BY HUMAN

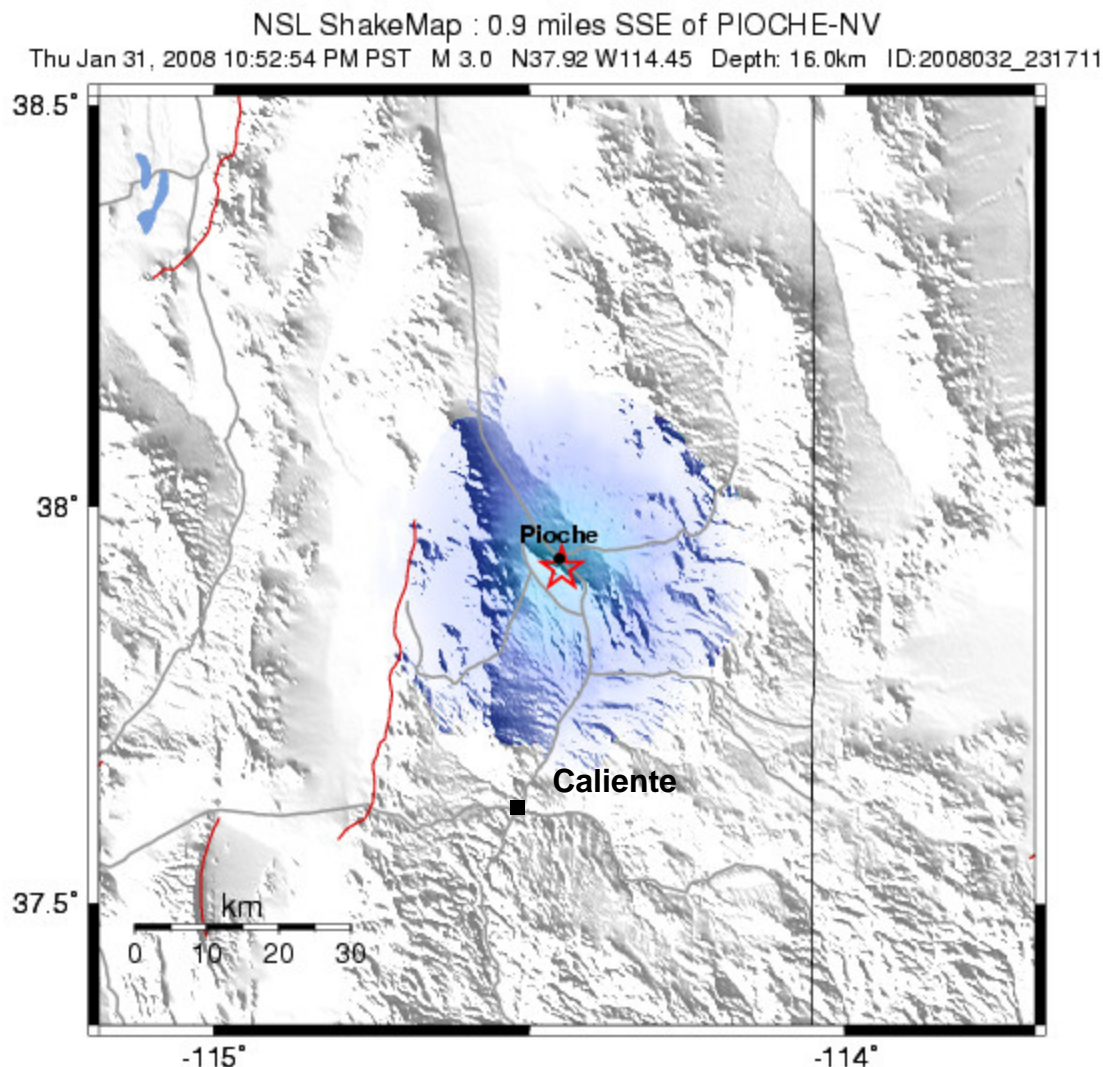
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC. (%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL. (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

ShakeMap from the Nevada Seismological Laboratory at UNR

**Magnitude 3.0
1 mile SSE of
Pioche
on Jan. 31, 2008**

**The earthquake
was not obviously
on a mapped fault.**

**A magnitude 6.0
earthquake can
occur anywhere in
Nevada, on a fault
that is not exposed
at the Earth's
surface.**



Map Version 3 Processed Fri Feb 1, 2008 07:51:38 AM PST,

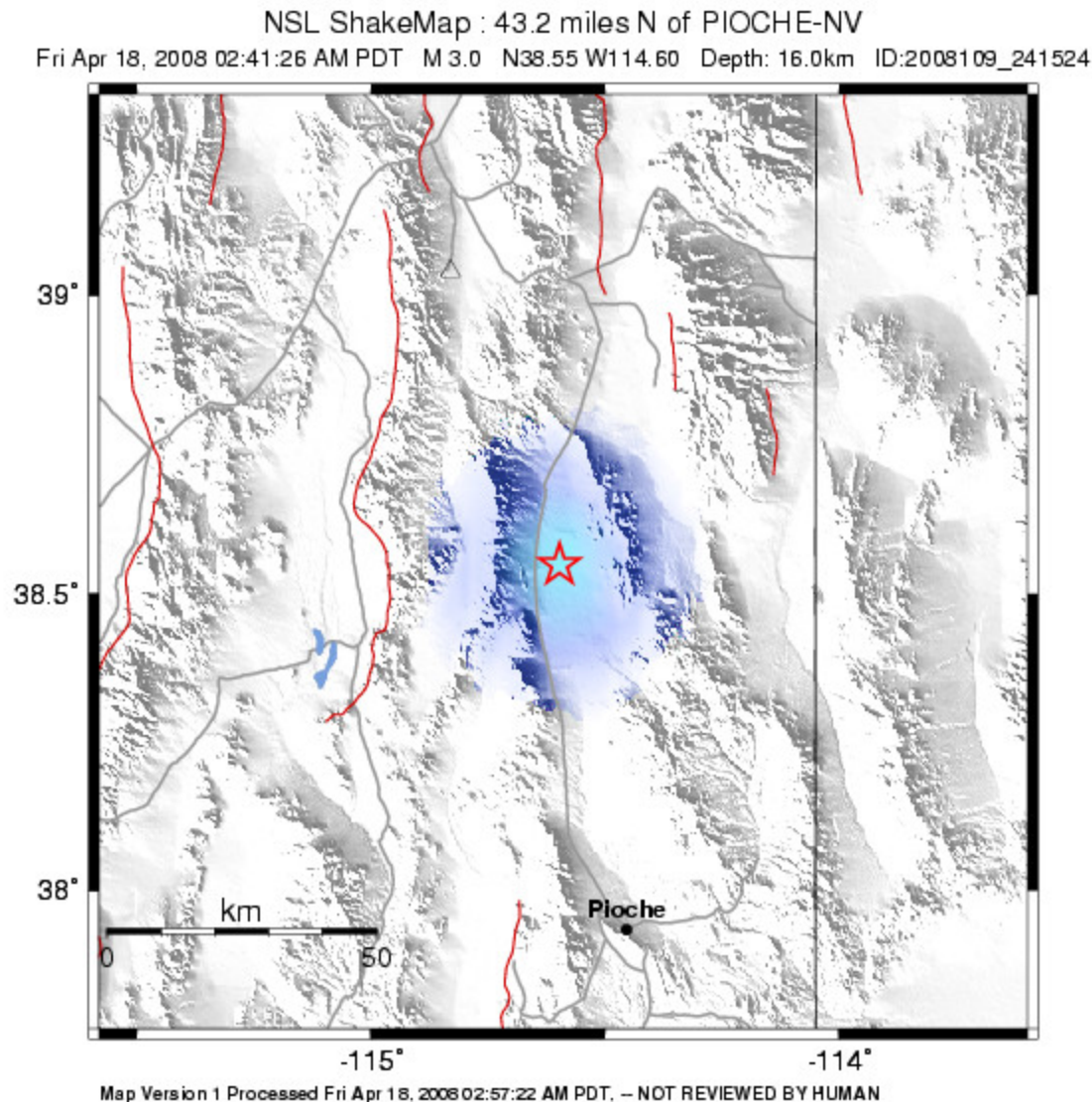
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC (%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

**ShakeMap from the
Nevada
Seismological
Laboratory at UNR**

**Magnitude 3.0
43 miles N of
Pioche
on April 9, 2008**

**The earthquake
was not obviously
on a mapped fault.**

**A magnitude 6.0
earthquake can
occur anywhere in
Nevada, on a fault
that is not exposed
at the Earth's
surface.**



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC. (%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL. (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Look for a fault | Find Address

Results

- ☒ 100 Front Street, Calie
- ☒ 100 Front St, Caliente

Map Contents

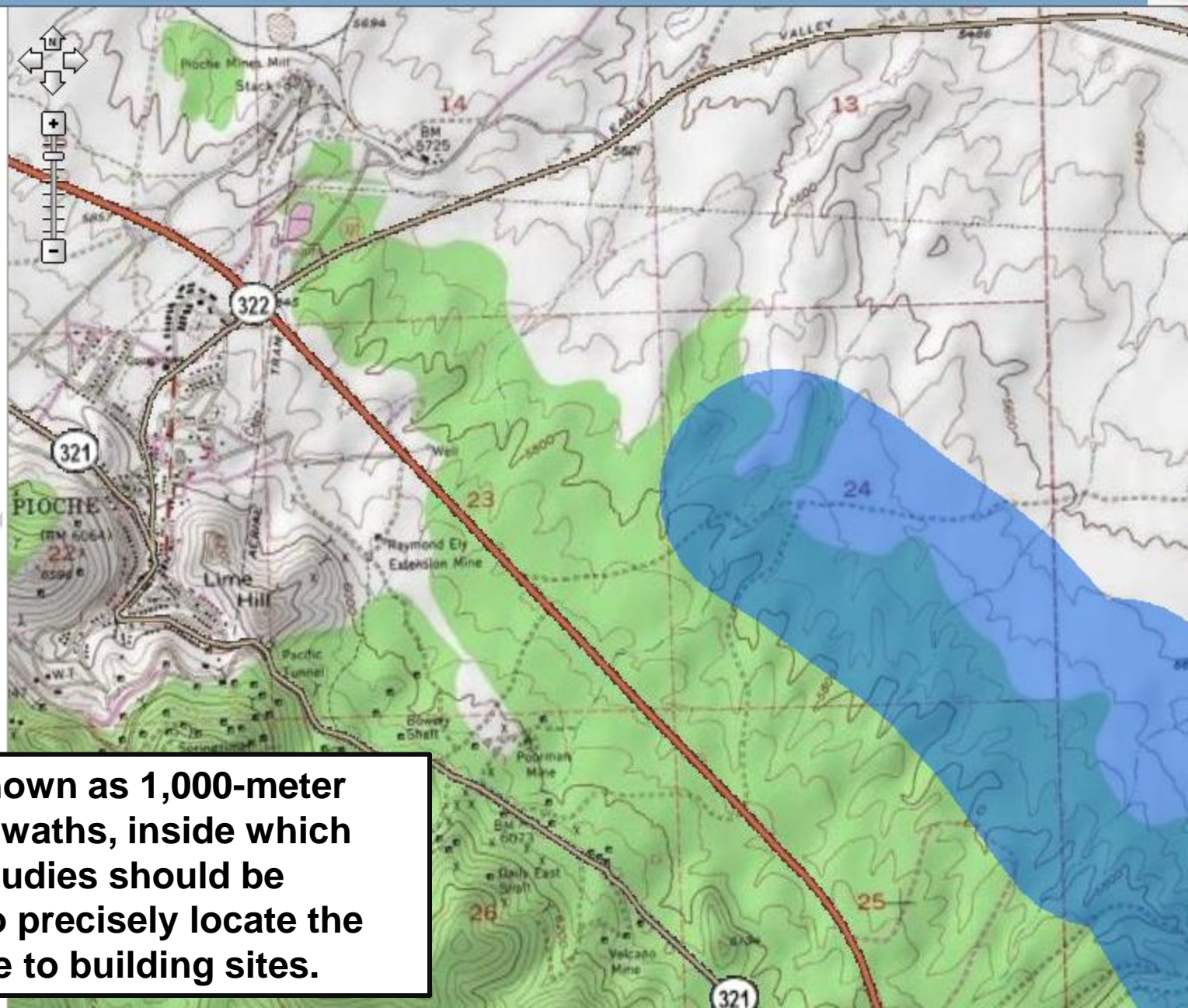
- ☒ Quaternary_Faults

Legend

- ☒ Historic - within the
- ☒ Historic - within the
- ☒ latest Pleistocene &
- ☒ latest Pleistocene &
- ☒ late Quaternary - w
- ☒ late Quaternary - w
- ☒ middle Quaternary
- ☒ middle Quaternary
- ☒ Quaternary - within
- ☒ Quaternary - within

Base Data

- ☒ 9i10glj_TOPO_data
- ☒ USGS_aerial_photographs



Faults are shown as 1,000-meter (3,281-feet) swaths, inside which geological studies should be conducted to precisely locate the faults relative to building sites.

Results

- ☒ 100 Front Street, Calie
- ☒ 100 Front St, Caliente

Map Contents

- ☒ Quaternary_Faults

Legend

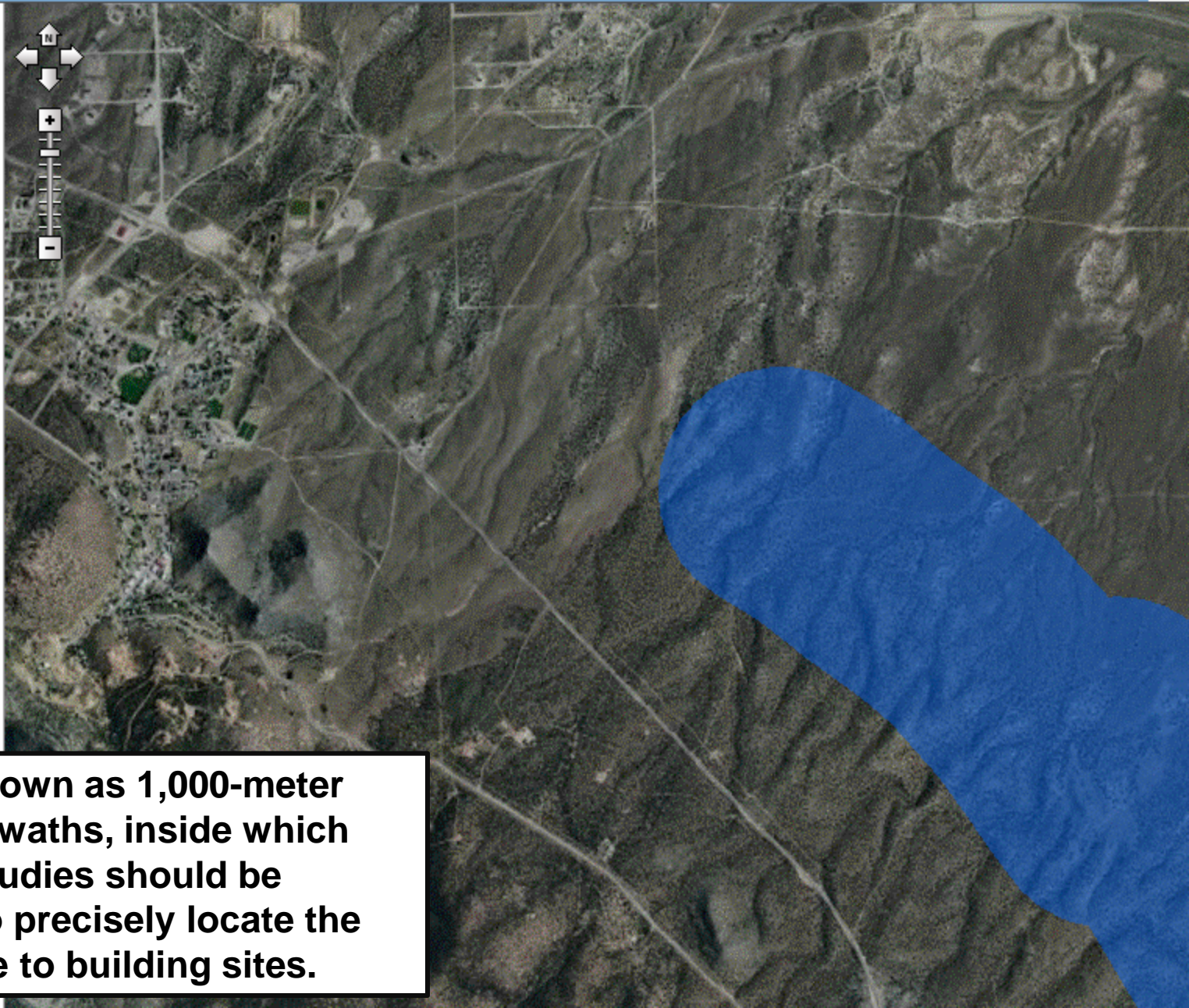
- ☒ Historic - within the
- ☒ Historic - within the
- ☒ latest Pleistocene &
- ☒ latest Pleistocene &
- ☒ late Quaternary - w
- ☒ late Quaternary - w
- ☒ middle Quaternary
- ☒ middle Quaternary
- ☒ Quaternary - within
- ☒ Quaternary - within

Base Data

- ☐ 9i10glj_TOPO_data

Base Data

- ☒ USGS_aerial_photographs



Faults are shown as 1,000-meter (3,281-feet) swaths, inside which geological studies should be conducted to precisely locate the faults relative to building sites.

Look for a fault | Find Address



Results

Map Contents

☒ Quaternary_Faults

Legend

- Historic - within the
- ▨ Historic - within the
- ▨ latest Pleistocene &
- ▨ latest Pleistocene &
- ▨ late Quaternary - w
- ▨ late Quaternary - w
- ▨ middle Quaternary
- ▨ middle Quaternary
- ▨ Quaternary - within
- ▨ Quaternary - within

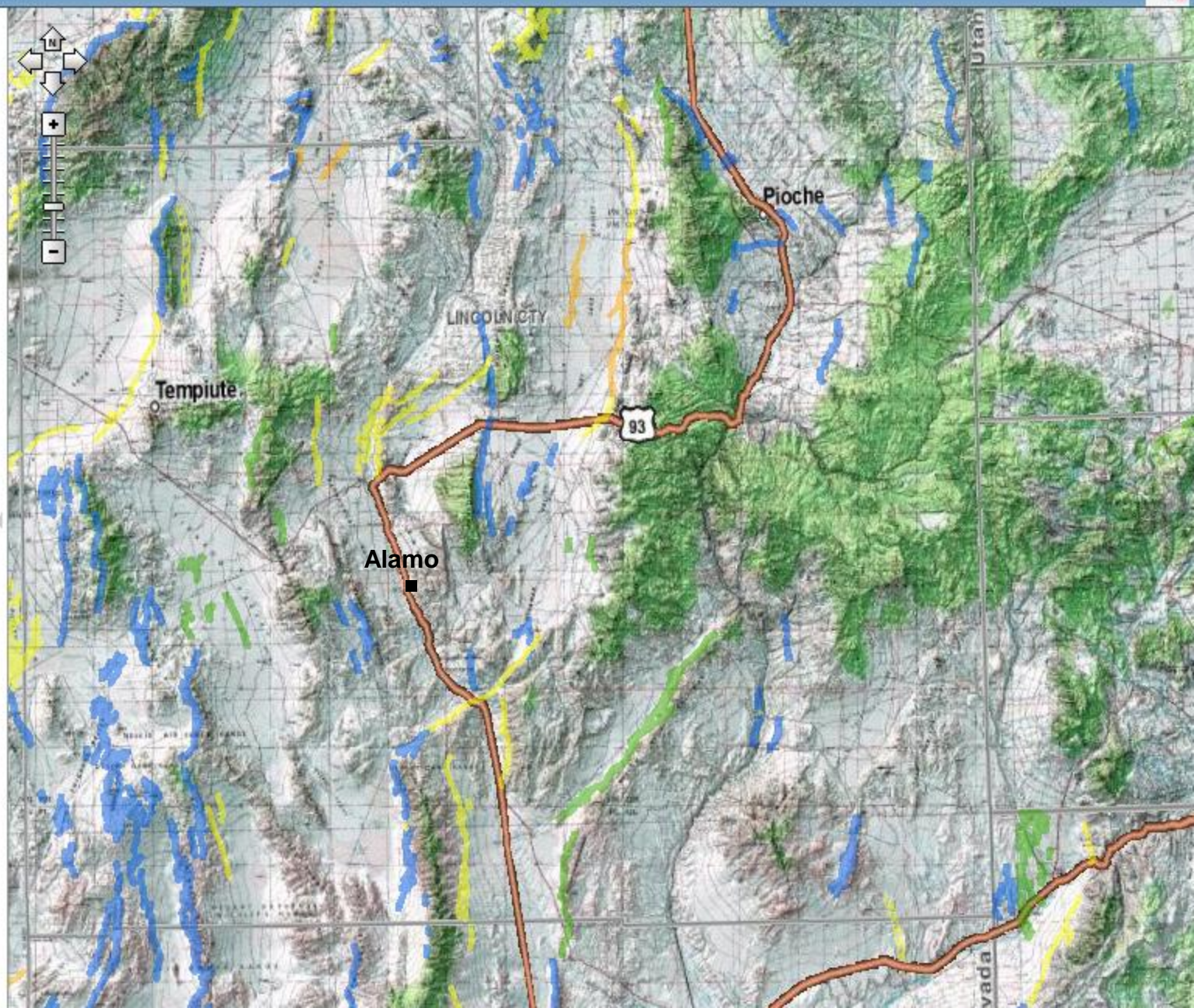
Base Data

☒ 9i10glj_TOPO_data

Base Data

☒ USGS_aerial_photographs

Base Data



Look for a fault | Find Address

Results

Map Contents

☒ Quaternary_Faults

Legend

- Historic - within the
- ▨ Historic - within the
- ▨ latest Pleistocene &
- ▨ latest Pleistocene &
- ▨ late Quaternary - w
- ▨ late Quaternary - w
- ▨ middle Quaternary
- ▨ middle Quaternary
- ▨ Quaternary - within
- ▨ Quaternary - within

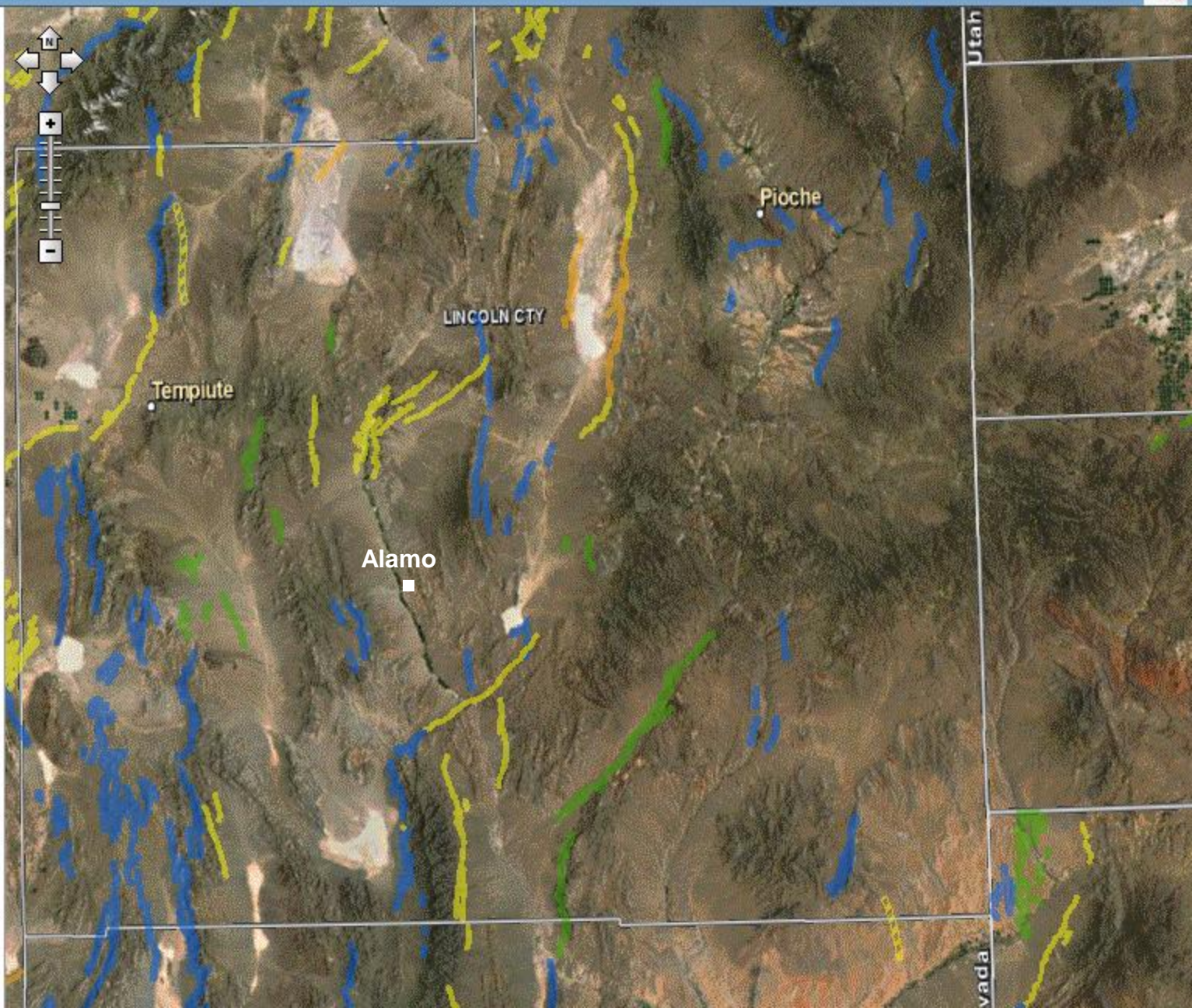
Base Data

☐ 9i10glj_TOPO_data

Base Data

☒ USGS_aerial_photographs

Base Data



Look for a fault | Find Address

Lincoln County has both normal and strike-slip faults.

Results

Map Contents

☒ Quaternary_Faults

Legend

- Historic - within the
- ▨ Historic - within the
- ▨ latest Pleistocene &
- ▨ latest Pleistocene &
- ▨ late Quaternary - w
- ▨ late Quaternary - w
- ▨ middle Quaternary
- ▨ middle Quaternary
- ▨ Quaternary - within
- ▨ Quaternary - within

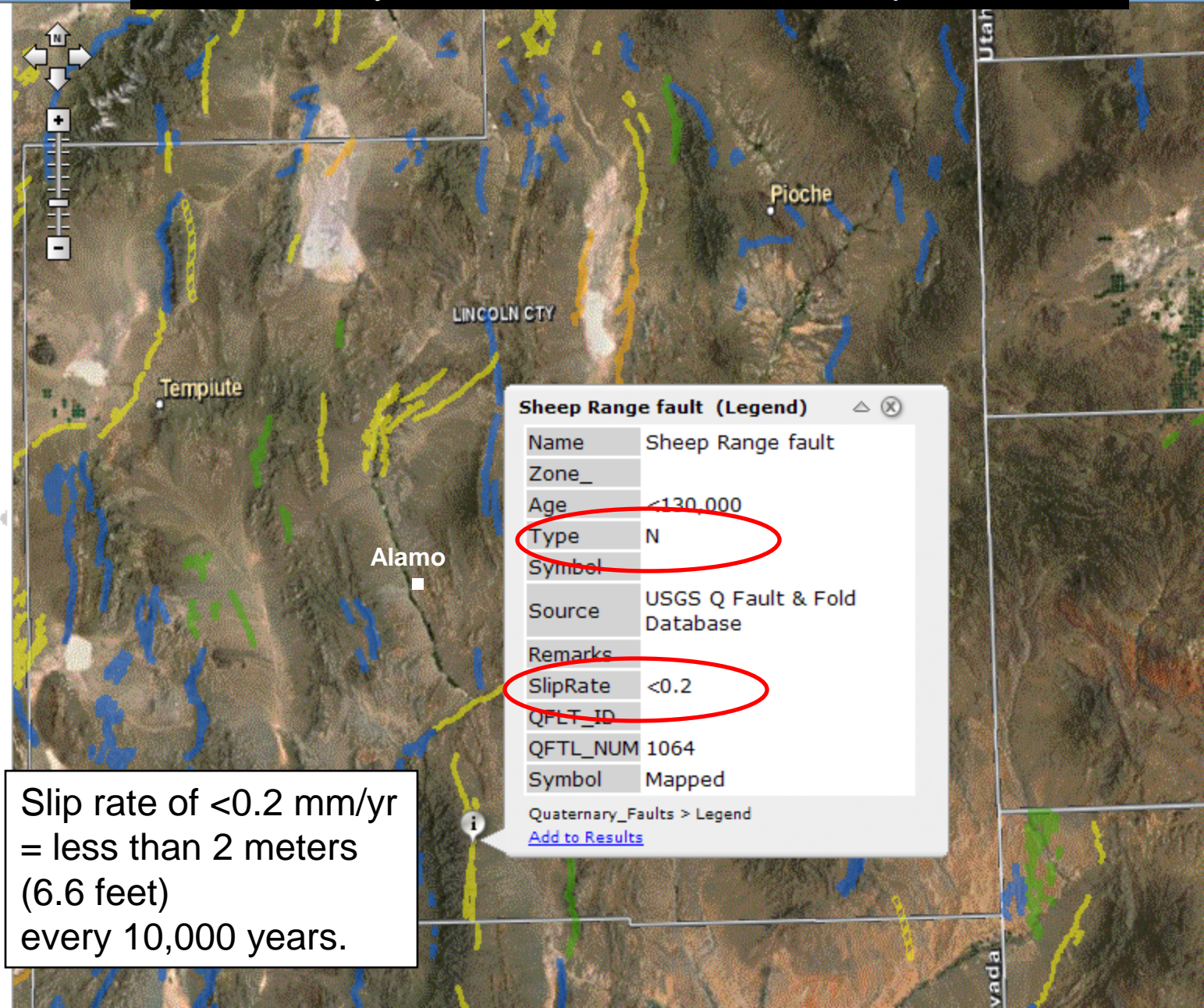
Base Data

☐ 9i10glj_TOPO_data

Base Data

☒ USGS_aerial_photographs

Base Data



Sheep Range fault (Legend)

Name	Sheep Range fault
Zone_	
Age	<130,000
Type	N
Symbol	
Source	USGS Q Fault & Fold Database
Remarks	
SlipRate	<0.2
QFLT_ID	
QFTL_NUM	1064
Symbol	Mapped

Quaternary_Faults > Legend

[Add to Results](#)

Slip rate of <0.2 mm/yr
= less than 2 meters
(6.6 feet)
every 10,000 years.

Look for a fault | Find Address

Lincoln County has both normal and strike-slip faults.

Results

Map Contents

☒ Quaternary_Faults

Legend

- Historic - within the
- ▨ Historic - within the
- ▨ latest Pliocene &
- ▨ latest Pliocene &
- ▨ late Quaternary - w
- ▨ late Quaternary - w
- ▨ middle Quaternary
- ▨ middle Quaternary
- ▨ Quaternary - within
- ▨ Quaternary - within

Base Data

☐ 9i10glj_TOPO_data

Base Data

☒ USGS_aerial_photographs

Base Data

Maynard Lake fault (Legend)

Name	Maynard Lake fault
Zone_	
Age	<130,000
Type	SS
Symbol	
Source	USGS Q Fault & Fold Database
Remarks	
SlipRate	<0.2
QFLT_ID	
QFTL_NUM	1122
Symbol	Mapped

Quaternary_Faults > Legend

[Add to Results](#)

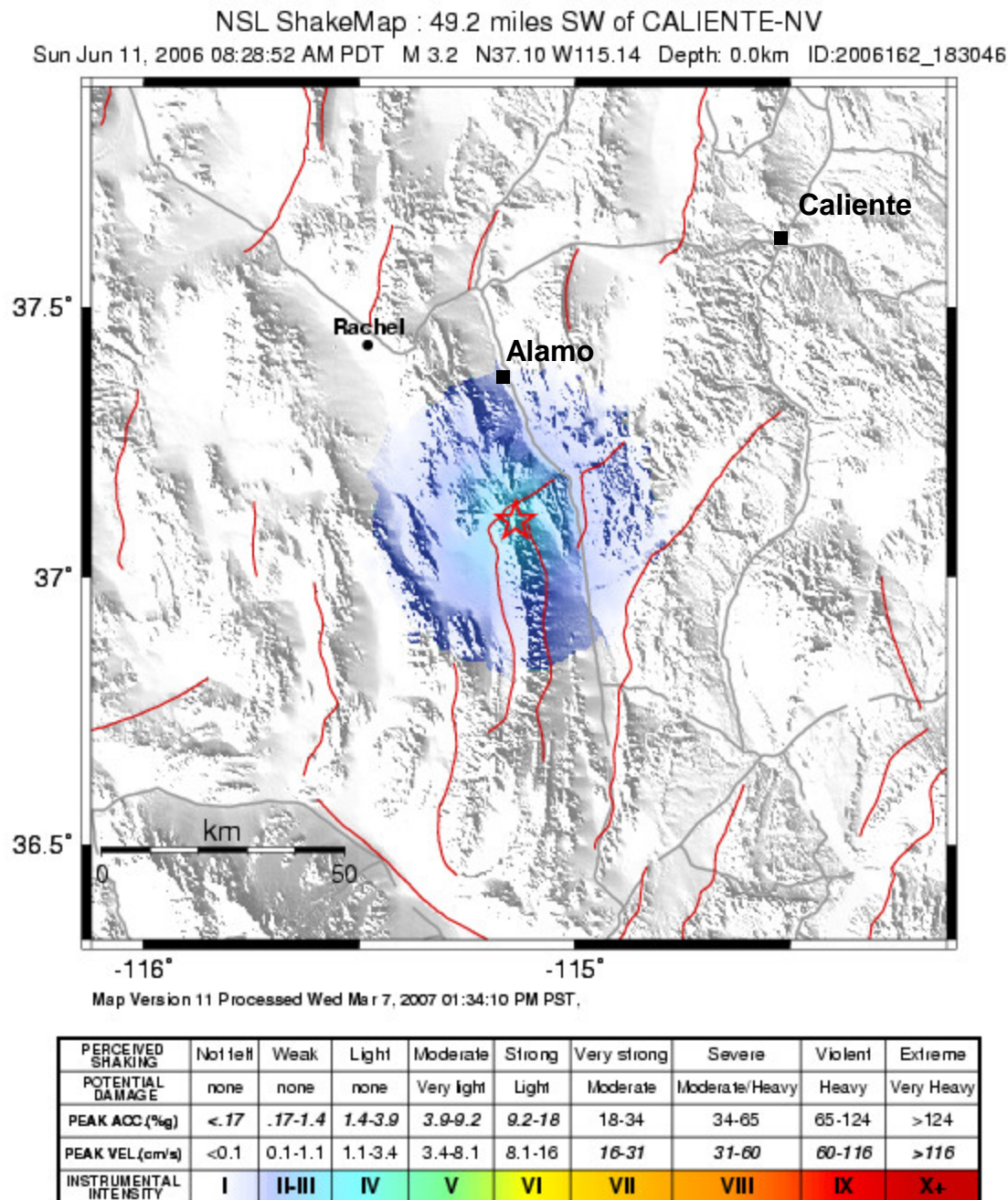
Slip rate of <0.2 mm/yr
= less than 2 meters
(6.6 feet)
every 10,000 years.

ShakeMap from the Nevada Seismological Laboratory at UNR

**Magnitude 3.2
49 miles SW of
Caliente
on June 11, 2006**

Near Alamo

**A magnitude 6.0
earthquake can
occur anywhere in
Nevada, on a fault
that is not exposed
at the Earth's
surface.**



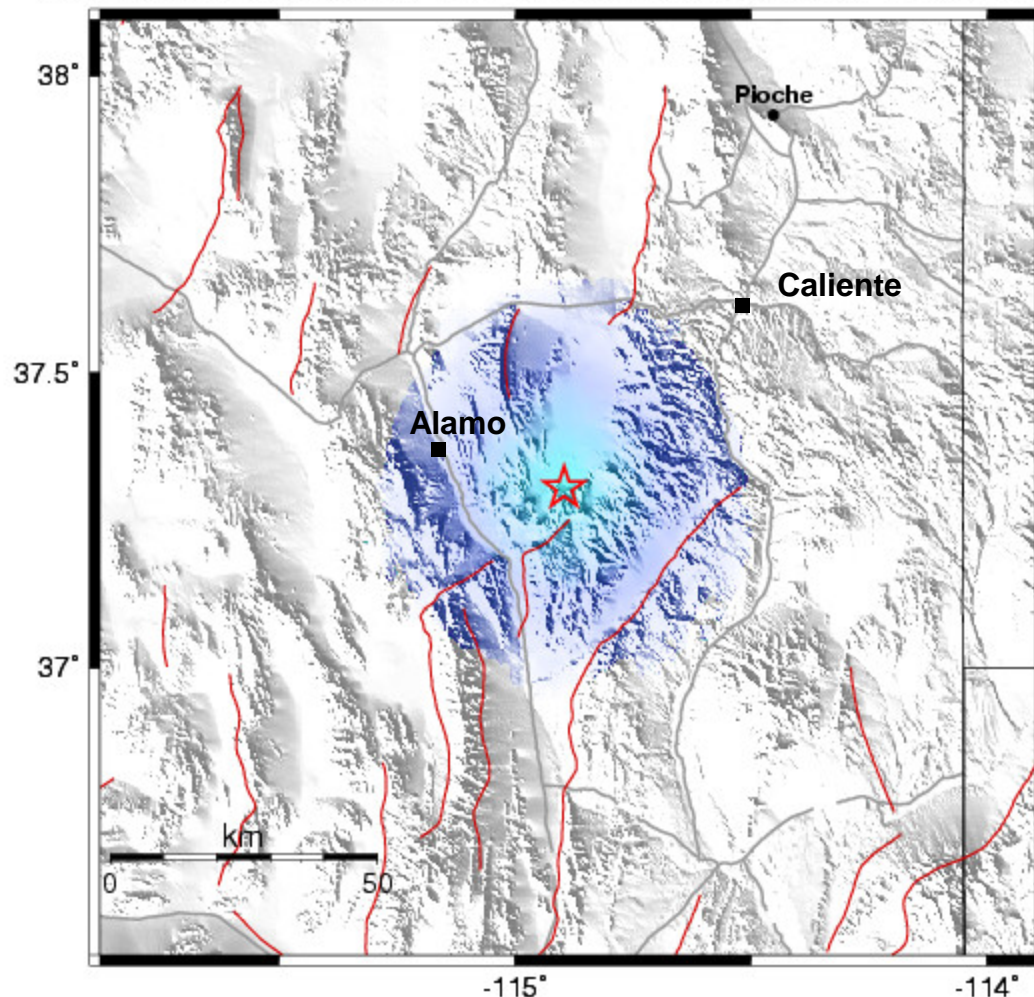
ShakeMap from the Nevada Seismological Laboratory at UNR

**Magnitude 3.5
30 miles SW of Caliente
on June 13, 2006**

Near Alamo

A magnitude 6.0 earthquake can occur anywhere in Nevada, on a fault that is not exposed at the Earth's surface.

NSL ShakeMap : 29.9 miles SW of CALIENTE-NV
Tue Jun 13, 2006 02:18:05 AM PDT M 3.5 N37.31 W114.90 Depth: 0.0km ID:2006164_183145



Map Version 11 Processed Wed Mar 7, 2007 01:36:57 PM PST,

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC (%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

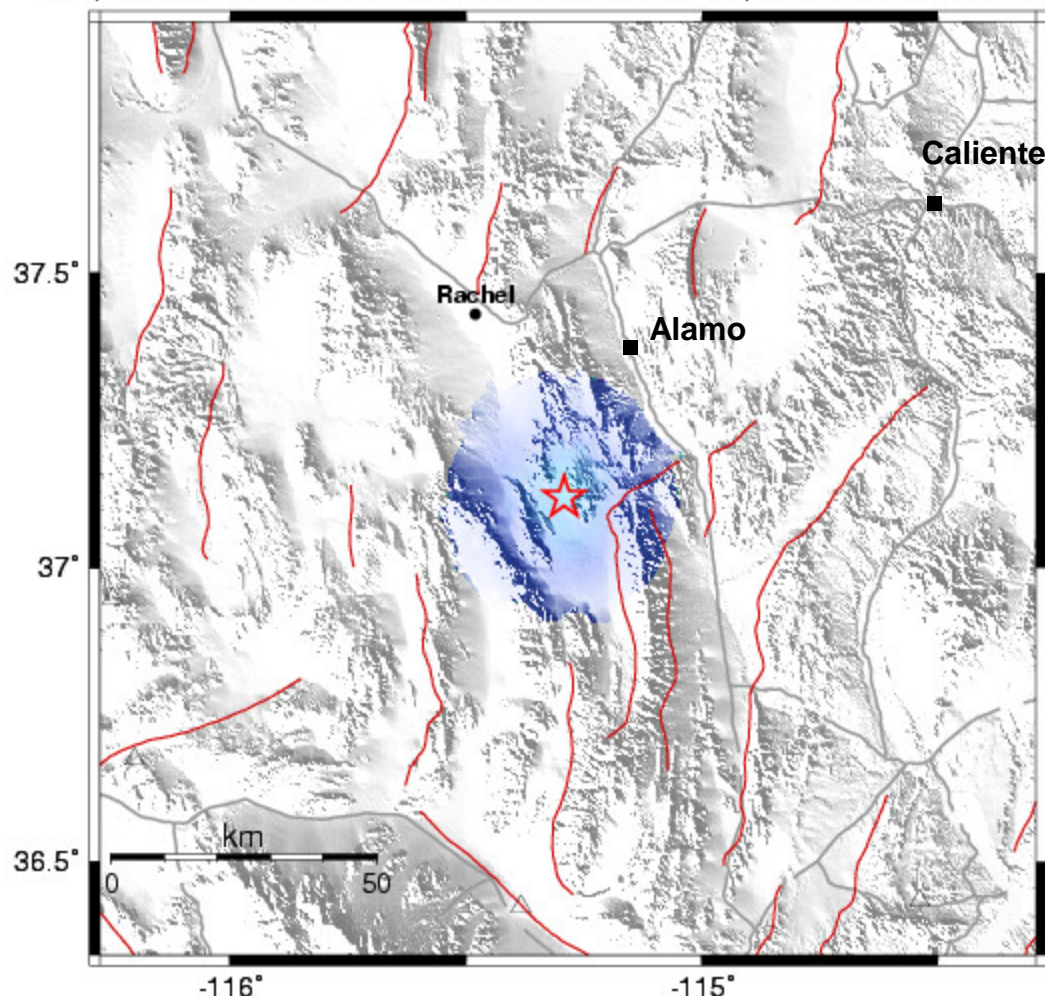
ShakeMap from the Nevada Seismological Laboratory at UNR

Magnitude 3.9
55 miles SW of Caliente
on April 27, 2007
at 8:42 a.m.

Near Alamo

A magnitude 6.0 earthquake can occur anywhere in Nevada, on a fault that is not exposed at the Earth's surface.

NSL ShakeMap : 54.7 miles SW of CALIENTE-NV
 Fri Apr 27, 2007 08:42:50 AM PDT M 3.9 N37.12 W115.29 Depth: 3.8km ID:2007117_205434



Map Version 3 Processed Sat Apr 28, 2007 10:18:37 AM PDT, -- NOT REVIEWED BY HUMAN

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC (%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

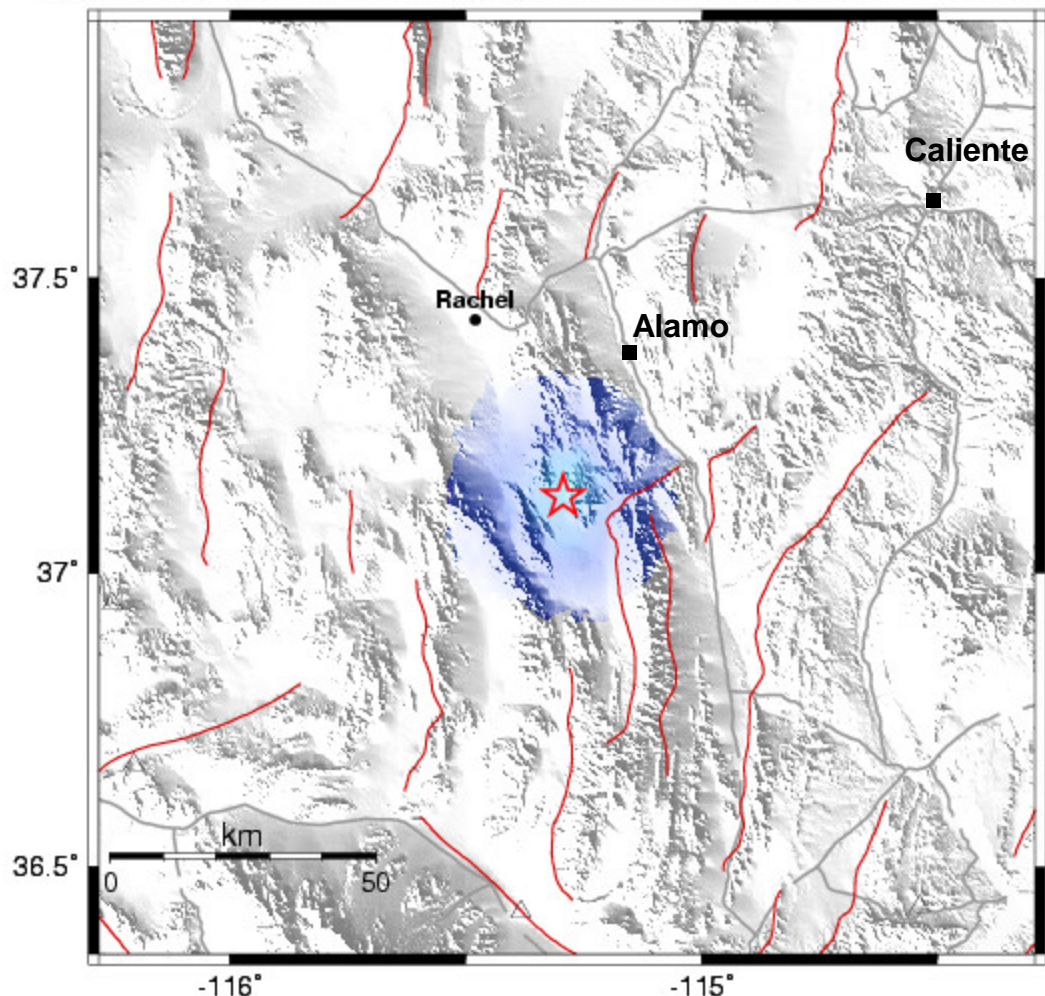
ShakeMap from the Nevada Seismological Laboratory at UNR

Magnitude 3.6
54 miles SW of Caliente
on April 27, 2007
at 12:55 p.m.

Near Alamo

A magnitude 6.0 earthquake can occur anywhere in Nevada, on a fault that is not exposed at the Earth's surface.

NSL ShakeMap : 54.3 miles SW of CALIENTE-NV
 Fri Apr 27, 2007 12:55:11 PM PDT M 3.6 N37.13 W115.29 Depth: 9.2km ID:2007117_205477



Map Version 3 Processed Sat Apr 28, 2007 10:23:07 AM PDT, - NOT REVIEWED BY HUMAN

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC (%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

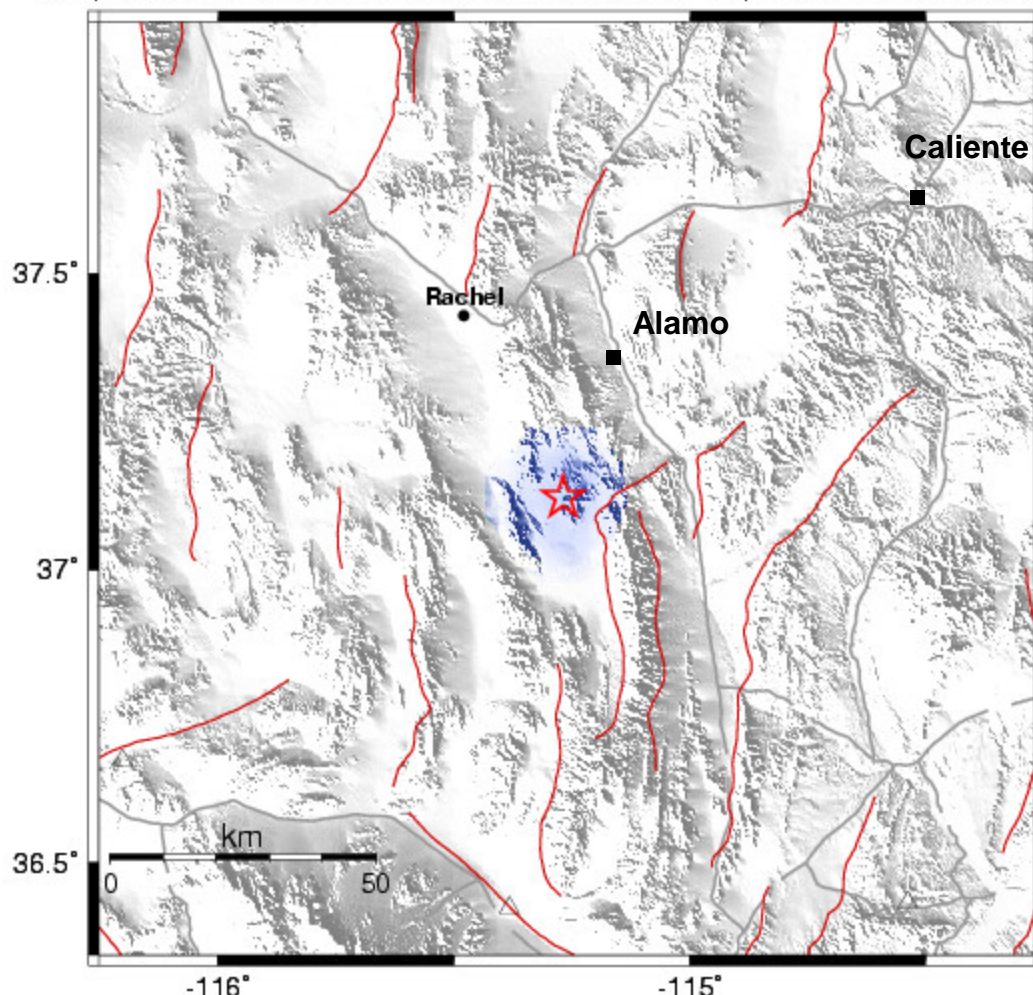
ShakeMap from the Nevada Seismological Laboratory at UNR

Magnitude 3.1
54 miles SW of Caliente
on April 27, 2007
at 6:40 p.m.

Near Alamo

A magnitude 6.0 earthquake can occur anywhere in Nevada, on a fault that is not exposed at the Earth's surface.

NSL ShakeMap : 53.6 miles SW of CALIENTE-NV
 Fri Apr 27, 2007 06:40:36 PM PDT M 3.1 N37.12 W115.27 Depth: 0.0km ID:2007118_205510



Map Version 3 Processed Sat Apr 28, 2007 10:29:34 AM PDT, -- NOT REVIEWED BY HUMAN

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC (%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

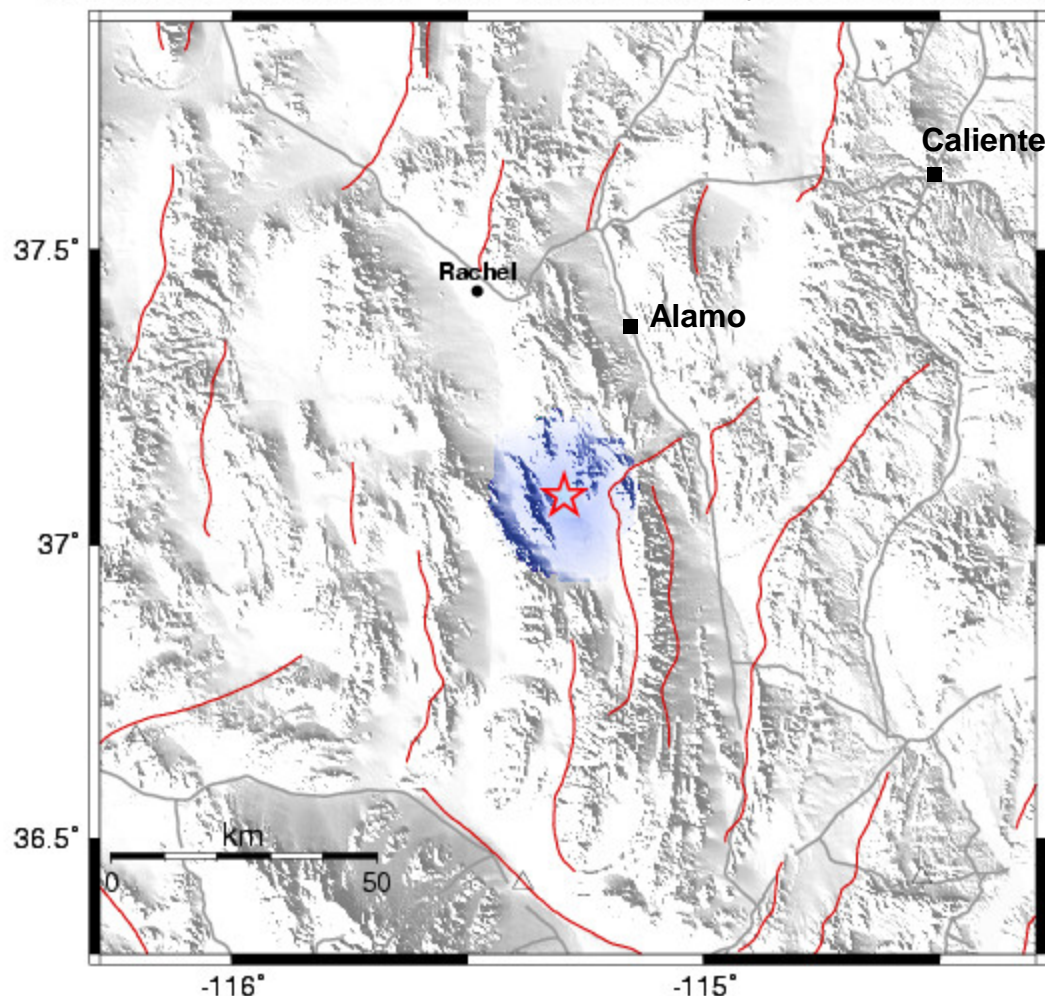
ShakeMap from the Nevada Seismological Laboratory at UNR

Magnitude 3.0
54 miles SW of
Caliente
on July 17, 2007

Near Alamo

A magnitude 6.0
earthquake can
occur anywhere in
Nevada, on a fault
that is not exposed
at the Earth's
surface.

NSL ShakeMap : 56.5 miles SW of CALIENTE-NV
 Tue Jul 17, 2007 06:54:43 AM PDT M 3.0 N37.08 W115.30 Depth: 4.0km ID:2007198_213421



Map Version 1 Processed Tue Jul 17, 2007 07:16:15 AM PDT, -- NOT REVIEWED BY HUMAN

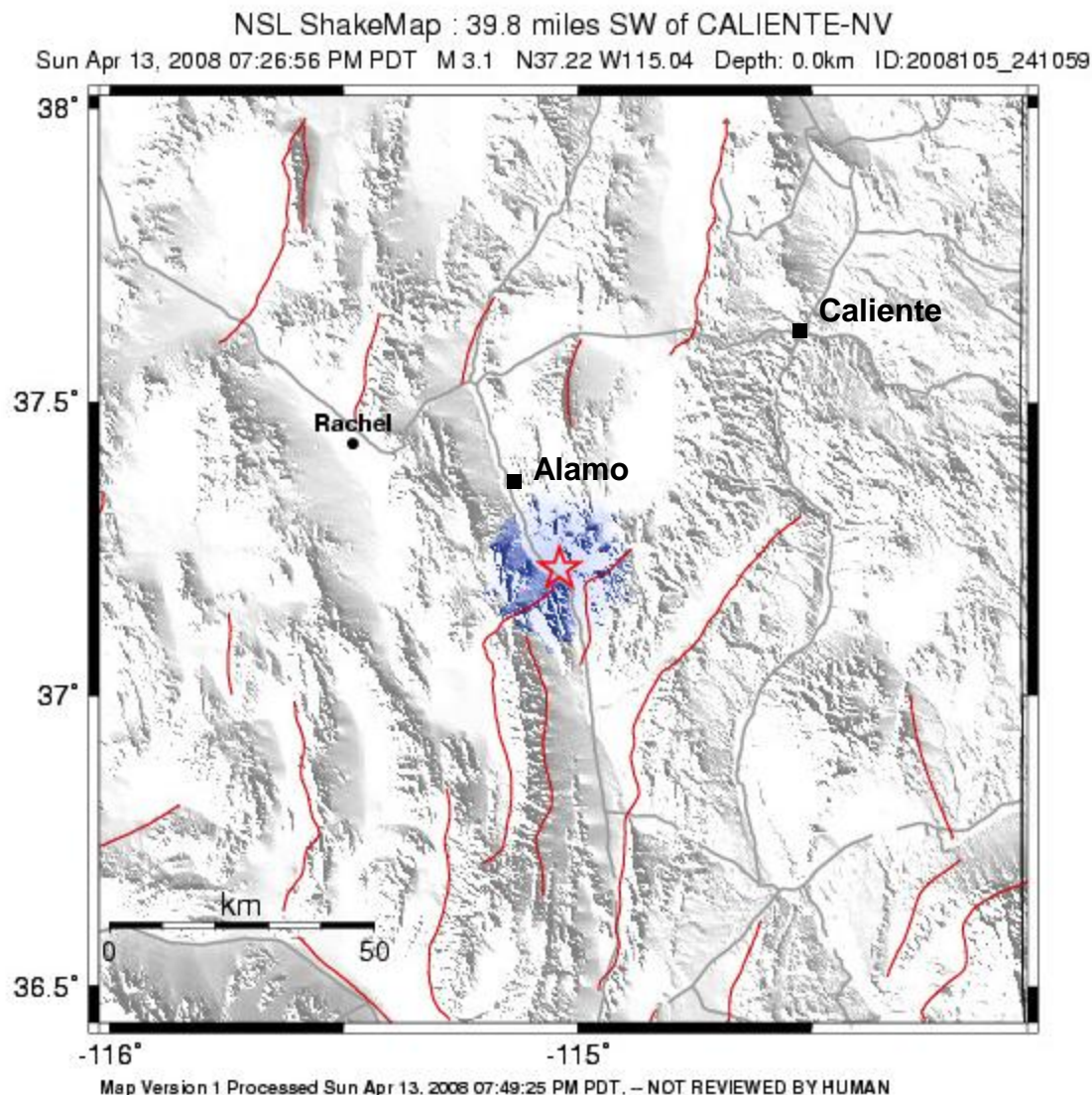
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

ShakeMap from the Nevada Seismological Laboratory at UNR

**Magnitude 3.1
40 miles SW of Caliente
on April 13, 2008**

Near Alamo

A magnitude 6.0 earthquake can occur anywhere in Nevada, on a fault that is not exposed at the Earth's surface.



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC (%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

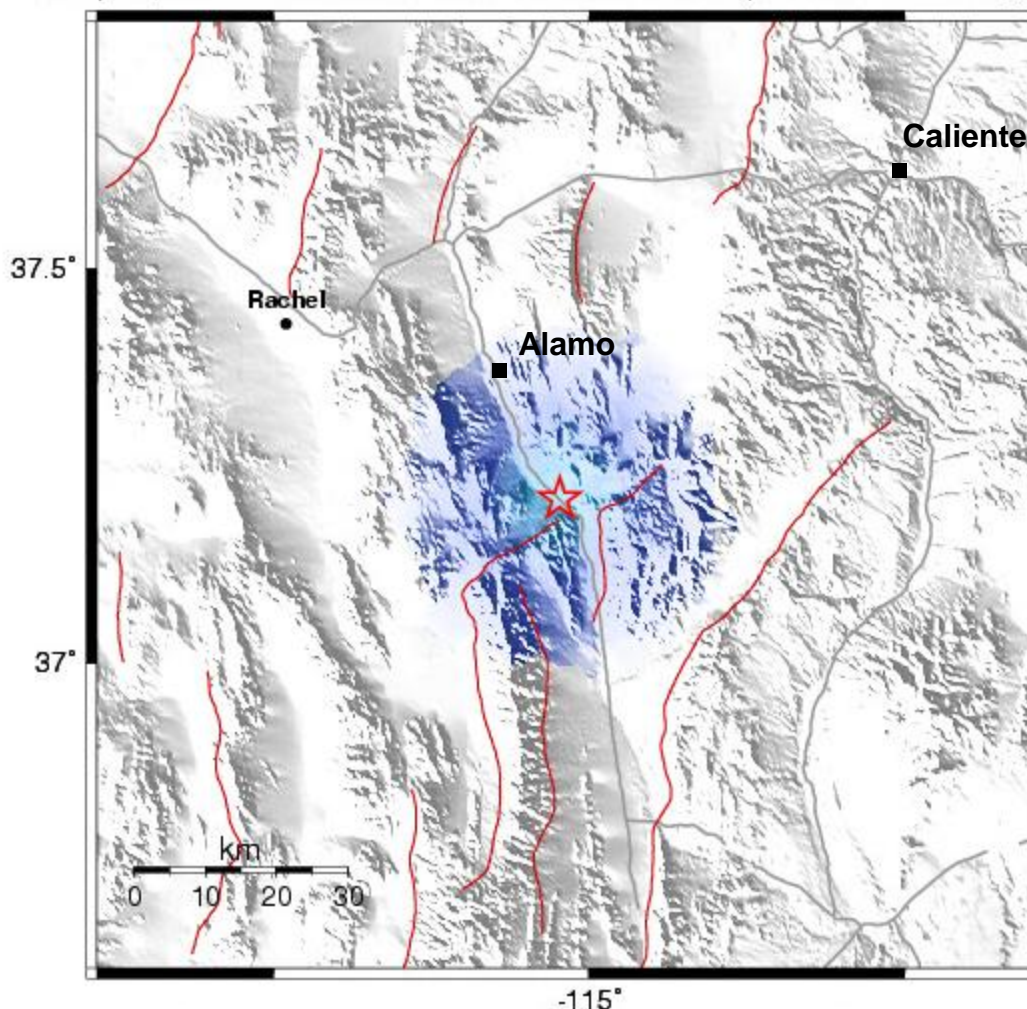
ShakeMap from the Nevada Seismological Laboratory at UNR

**Magnitude 3.1
40 miles SW of
Caliente
on April 15, 2008**

Near Alamo

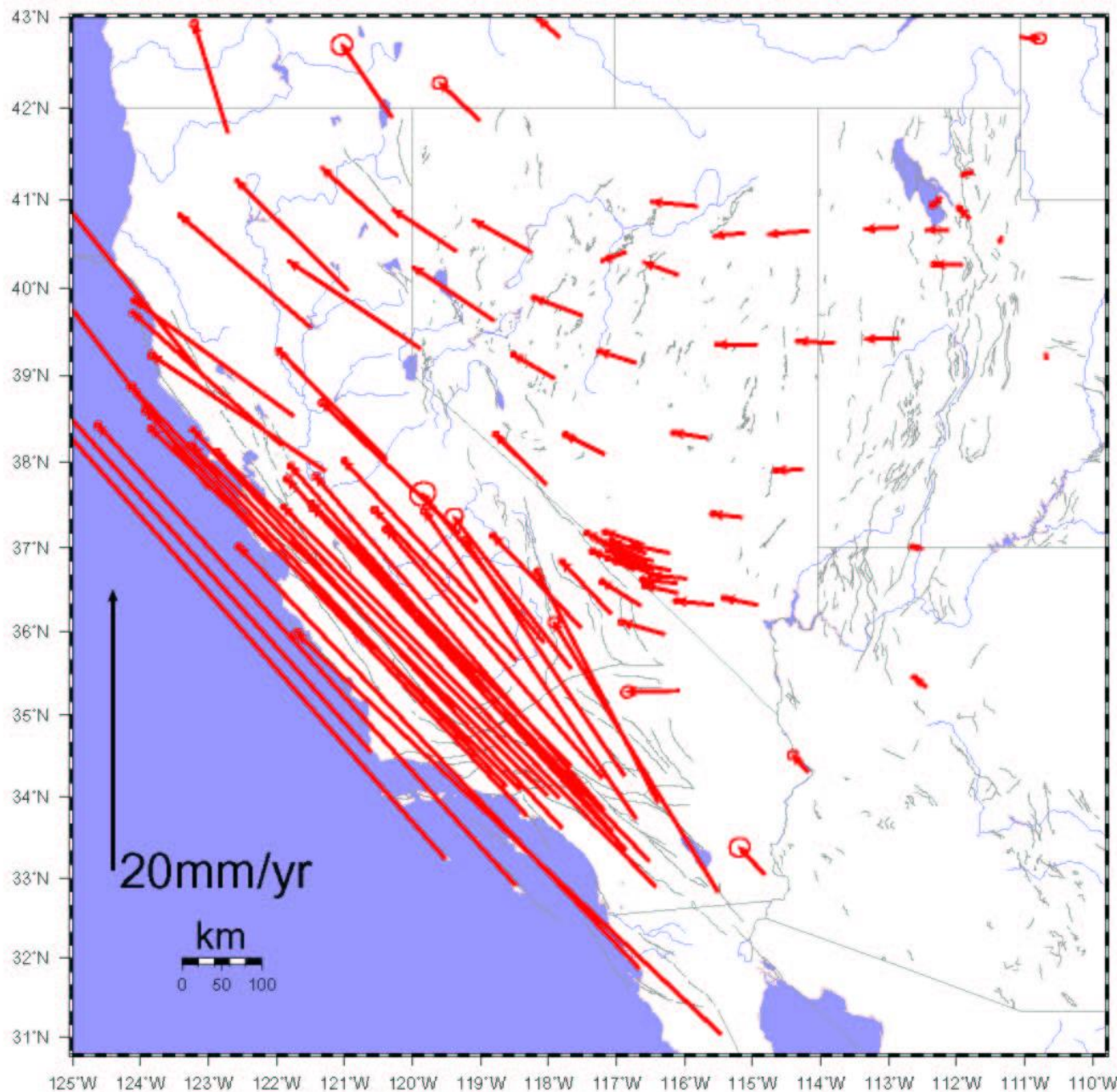
**A magnitude 6.0
earthquake can
occur anywhere in
Nevada, on a fault
that is not exposed
at the Earth's
surface.**

NSL ShakeMap : 40.5 miles SW of CALIENTE-NV
Tue Apr 15, 2008 06:38:00 AM PDT M 3.1 N37.21 W115.05 Depth: 5.3km ID:2008106_241151



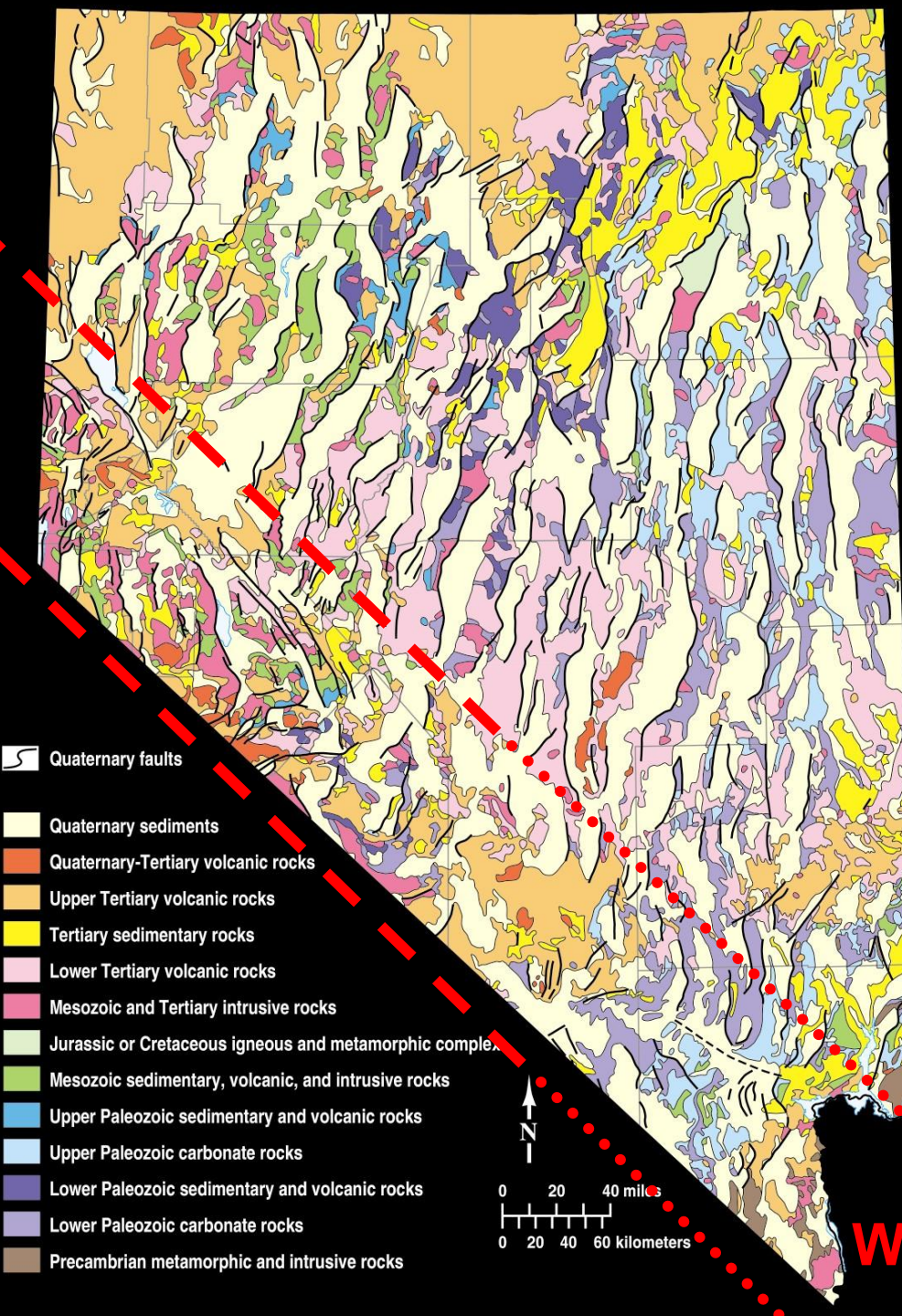
Map Version 3 Processed Tue Apr 15, 2008 01:52:59 PM PDT, -- NOT REVIEWED BY HUMAN

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+



(3) Geodetic data indicate that the Basin and Range province is gaining about 1.3 acres of area per year through crustal extension, and that western Nevada is accommodating ~20% of the North American-Pacific plate interaction.

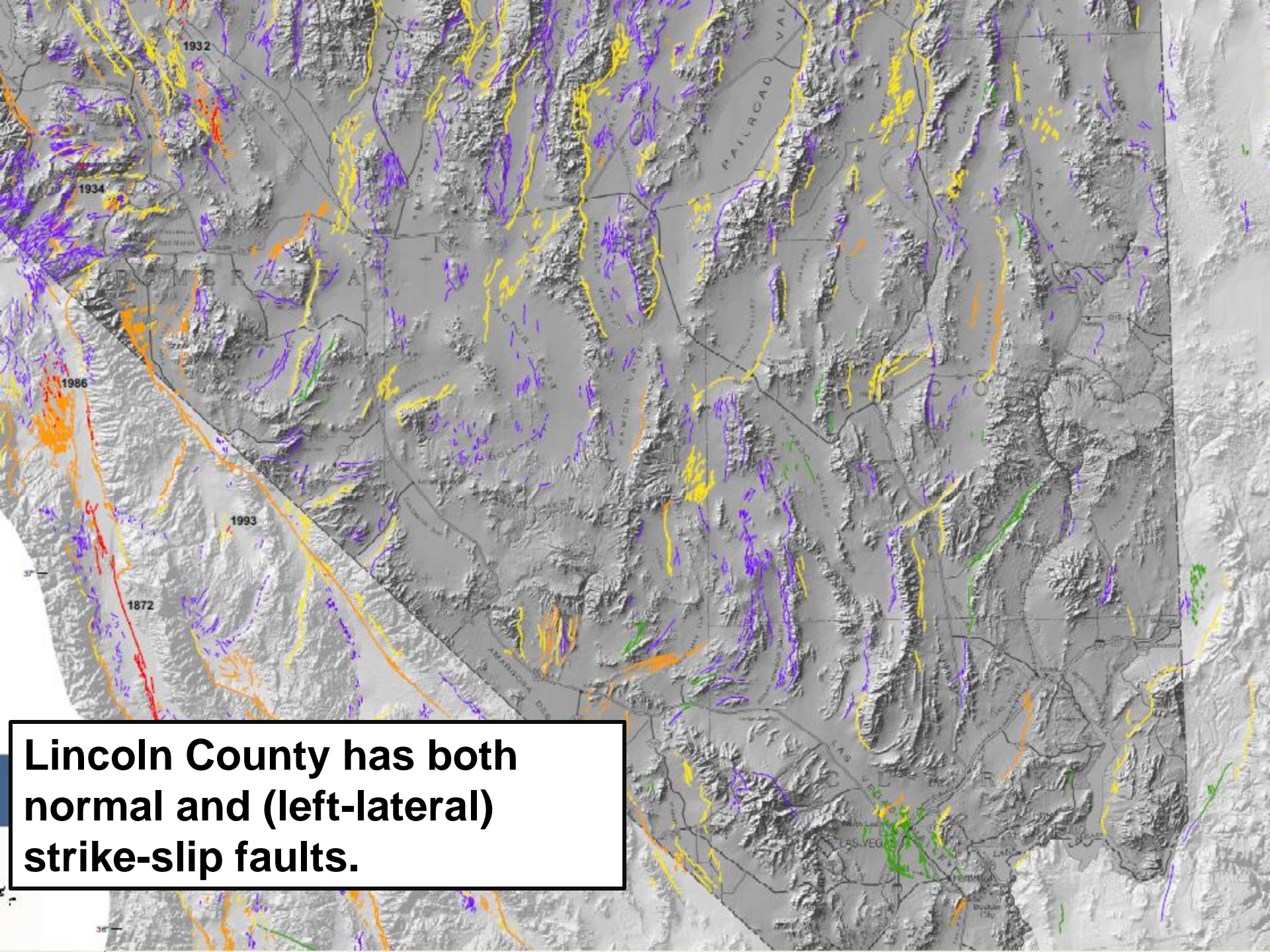
Kreemer and Hammond (2007)



In Nevada, much of the right-lateral shear between the North American and Pacific plates occurs along northwest-striking strike-slip faults of the Walker Lane.

Extension largely is accommodated along N- to NE-striking, basin-bounding normal faults.

Walker Lane



**Lincoln County has both
normal and (left-lateral)
strike-slip faults.**

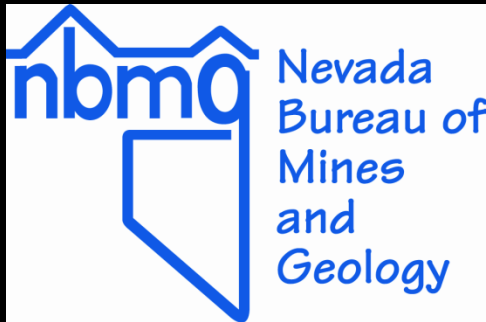
The hazard: expressed in terms of probability of an earthquake of a given magnitude occurring within 50 years and within 50 km of the community.

Community	% Probability of magnitude greater than or equal to magnitude				
	5.0	5.5	6.0	6.5	7.0
Dayton	>90	~80	70-75	50-55	12-15
Carson City	>90	~80	70	50-55	12-15
Reno	>90	~80	67	50	12-15
Stateline	>90	~80	60-70	40-50	10
Fallon	80-90	~60	35	20-25	6-8
Alamo	70-80	~50	20-25	6-8	<0.5
Caliente	50-60	~35	10-15	4	<0.5
Las Vegas	40-50	~30	12	4-5	<0.5
Elko	30-40	~25	10-15	6-8	0.5-1
Pioche	30-40	~20	6-10	2-3	<0.5
Wells	30-40	~20	9	6	0.5-1
Laughlin	10-20	~5	2-3	0.5-1	<0.5

Data are from the USGS at <http://eqint.cr.usgs.gov/eqprob/2002/index.php> .
 Values for magnitude 5.5 are extrapolated between 5.0 and 6.0.

**Earthquake faults occur throughout Nevada,
and potential losses from earthquakes are high
for many communities.**

NBMG Open-File Report 09-8, *Estimated Losses from Earthquakes near Nevada Communities*, demonstrates that the consequences of earthquakes can be huge in Nevada, particularly if individuals are not prepared.



Earthquake risks in Nevada are assessed by the Nevada Bureau of Mines and Geology using the Federal Emergency Management Agency's loss-estimation model, HAZUS-MH, and the U.S. Geological Survey's probabilistic seismic hazard analysis.

These loss estimates are useful in hazard-mitigation planning, in building scenarios for emergency response and recovery exercises, and in helping emergency managers and the Governor make decisions on official disaster declarations after an actual earthquake.

INCIDENT NAME - VIGILANT GUARD ^{TIME} 0600
7.1 MAGNITUDE EARTHQUAKE
INITIAL DAMAGE REPORT -
COLLEGE DORMITORY COLLAPSE w/ VICTIMS
LABORATORY / CHEMICAL FACILITY COLLAPSE w/ VICTIMS
INCIDENT COMMAND - RENO FIRE DEPT.
RESOURCES - RENO FD USE, ^{ON SCENE}
NEVADA TASK FORCE 1 - LAS VEGAS
REMSA, SPARKS PD,
REQUESTED - 92ND CIVIL SUPPORT TEAM - NATIONAL GUARD
LAS VEGAS
NATIONAL GUARD BATT'L + RESOURCES
FROM CALIFORNIA, HAWAII, ARIZONA,
UTAH, IDAHO, WASHINGTON STATE
INITIAL REPORT -
DAMAGE ALSO REPORTED - CARSON CITY, CHURCHILL CO.
LYON COUNTY, DOUGLAS COUNTY
STONEY SE - VIRGINIA CITY +
INDUSTRIAL DISTRICT
AFTERSHOCKS POSSIBLE -



Earthquake risks in Nevada are assessed by the Nevada Bureau of Mines and Geology using the Federal Emergency Management Agency's loss-estimation model, HAZUS-MH, and the U.S. Geological Survey's probabilistic seismic hazard analysis.

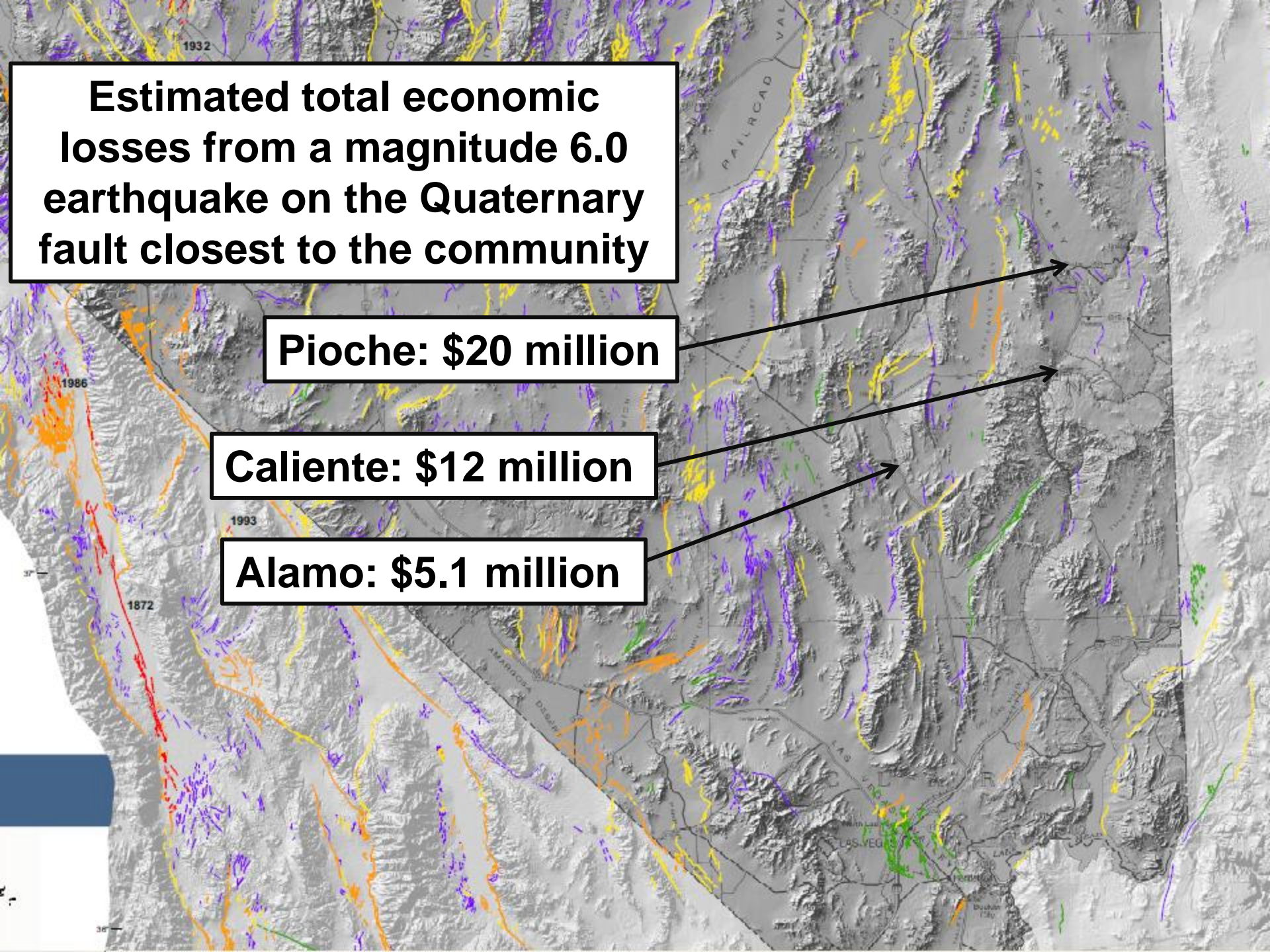
NBMG Open-File Report 09-8, *Estimated Losses from Earthquakes near Nevada Communities*, contains HAZUS scenarios for magnitude 5.0, 5.5, 6.0, 6.5, and 7.0 earthquakes near 38 communities in Nevada.

Uncertainties in the location of epicenters, depths, and magnitude, when combined with changing population and uncertainties in local effects (soil and rock types, assumptions about attenuation, basin geometry, liquefaction potential, and directivity), make loss estimates generally consistent within one order of magnitude (a factor of 10).

HAZUS estimates for total economic loss from a magnitude 6.0 earthquake and probability of an earthquake of this magnitude or greater occurring within 50 years and within 50 km of the community.

Community	Total Economic Loss	Probability in 50 years within 50 km
Las Vegas	\$7.2 billion	12%
Reno	\$1.9 billion	67%
Wells	\$30 million	9%
Pioche	\$20 million	6 to 10%
Caliente	\$12 million	10 to 15%
Alamo	\$5.1 million	20 to 25%

Total economic loss is from HAZUS. Probabilities are from the USGS at <http://eqint.cr.usgs.gov/eqprob/2002/index.php> .



Estimated total economic losses from a magnitude 6.0 earthquake on the Quaternary fault closest to the community

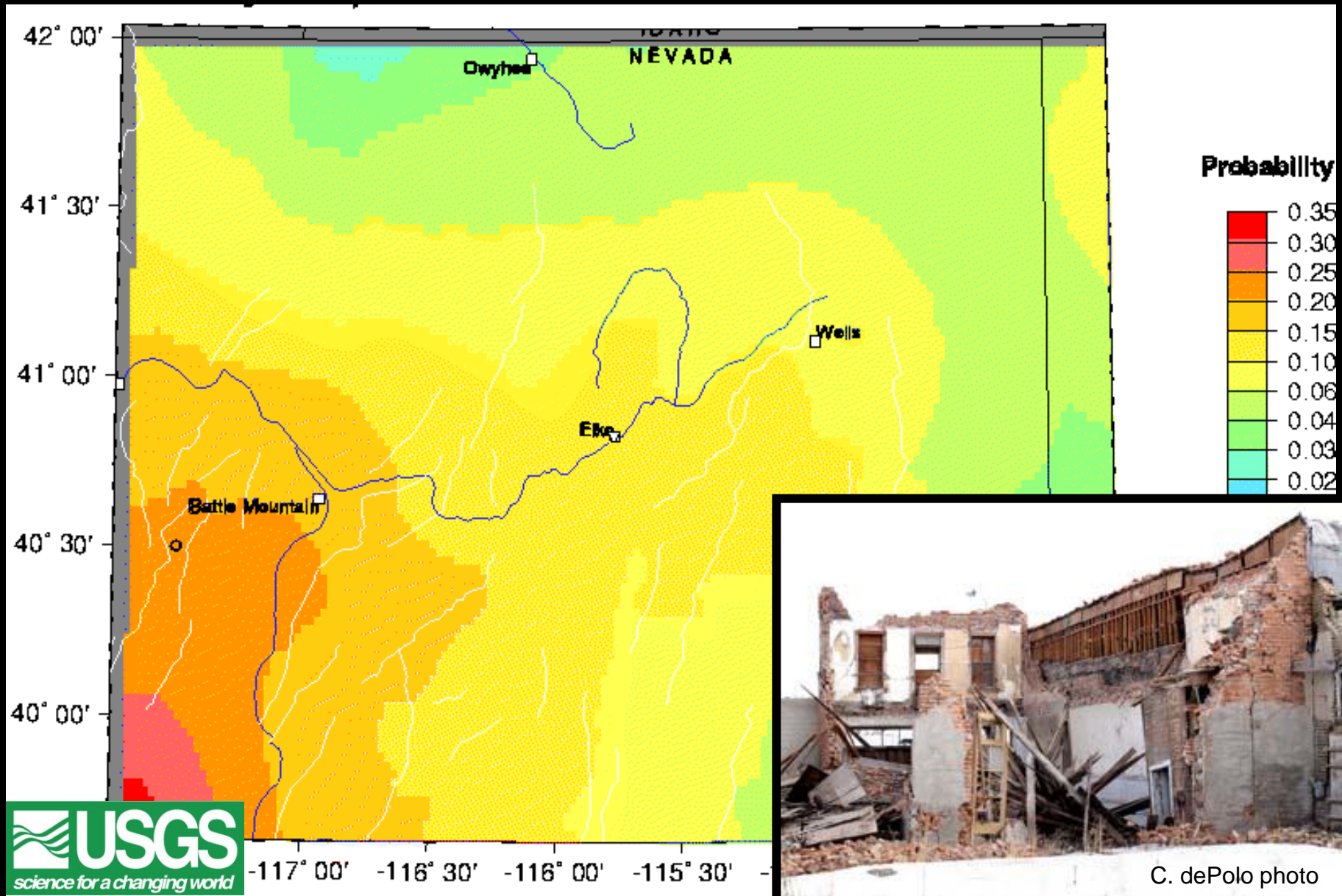
This figure is a topographic map of the Las Vegas area, showing various geological features and historical earthquake locations. The map is overlaid with colored lines representing different fault systems: purple for the Quaternary fault system, yellow for the Mojave Desert fault system, orange for the San Andreas fault system, and green for the Garlock fault system. Historical earthquake locations are marked with red dots and labeled with their respective years: 1932, 1986, 1993, and 1872. The map also shows major geographical features like the Railroad Valley, Lake Mead, and the city of Las Vegas. Three black arrows point from the text boxes to specific fault segments on the map.

Pioche: \$20 million

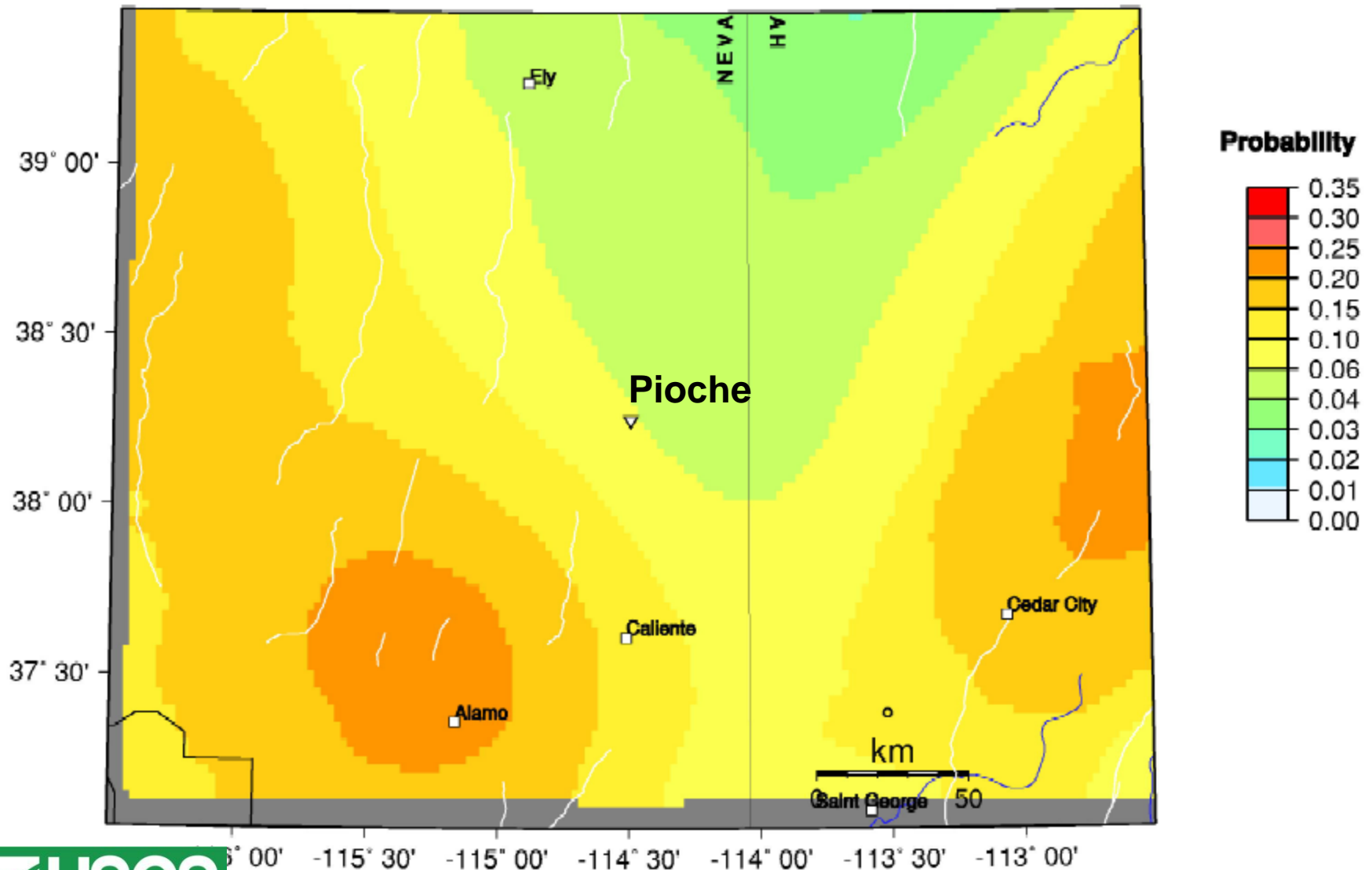
Caliente: \$12 million

Alamo: \$5.1 million

The probability of a magnitude 6.0 earthquake occurring within 50 km of Wells, Nevada within the next 50 years is approximately 9%.
It happened on 21 February 2008.



The probability of a magnitude 6.0 earthquake occurring within the next 50 years within 50 km of Caliente (10-15%) or Alamo (20-25%) is higher than for Wells.



Earthquake faults occur throughout Nevada, and potential losses from earthquakes are high for many communities.

The consequences of earthquakes can be huge in Nevada, particularly if individuals are not prepared.

A. Be prepared to respond.

B. Mitigate structural risks, largely through building codes and avoiding faults and areas of liquefaction.

C. Mitigate nonstructural risks.

Unreinforced masonry building (URM)
that collapsed during the Wells
earthquake on 21 February 2008



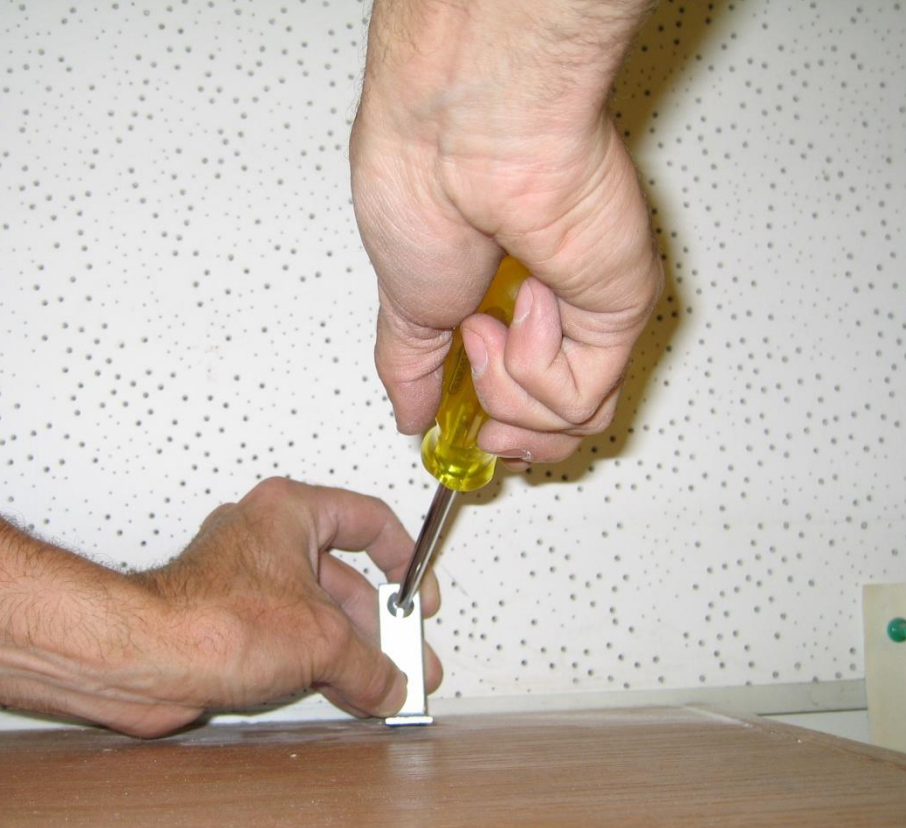
View from back, 20 May 2009



View from front, 20 May 2009



Nonstructural damage often can be easily prevented.



Earthquake-secure bookshelves in the office of the State Geologist

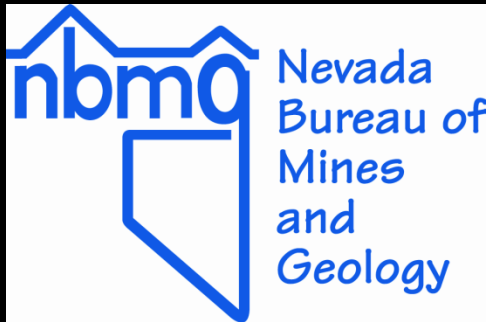


**Secured computers at the
Clark County Building Department**

Thank you!

And thanks to Craig dePolo, Gary Johnson, Christine Ballard, Heather Armeno, Irene Seeley, Linda D. Goar, and Jordan T. Hastings for their work on the open-file reports (OF 09-8 and 09-9), which are available as online documents at www.nbmng.unr.edu.

From there, go to online documents at <http://www.nbmng.unr.edu/dox/dox.htm>, then scroll down to OF 09-8 or 09-9. Link to the fault map from OF 09-9.





GREAT BASIN SCIENCE SAMPLE AND RECORDS LIBRARY

Nevada Bureau of Mines and Geology

University of Nevada, Reno

on the Campus of the Desert Research Institute

2175 Raggio Parkway, Reno, NV 89512

Cuttings from oil,
gas, and
geothermal
exploration and
production wells
6 May 2009



Seismic base isolation
for storage racks in the
warehouse section,
6 May 2009





RIDG.U.RAK®

Seismic Base Isolation System

Patent No's. 7,249,442 & 7,263,806



4 May 2009

**Large earthquakes can cluster
in time and location.**

**Large historical earthquakes in 1954-1959
near Fallon,
preceded by a possible large earthquake in 1852**

<u>Date</u>	<u>Magnitude</u>	<u>Near</u>
1852?	7.3	Fallon
July 6, 1954 (a)	6.6	Rainbow Mtn.
11 hours later (b)	6.0	Fourmile Flat
August 24, 1954 (c)	6.8	Stillwater
December 16, 1954 (d)	7.1	Fairview Peak
4 minutes later (e)	6.8	Dixie Valley
March 23, 1959	6.3	Dixie Valley

On the basis of historical seismic records, the Nevada Seismological Laboratory estimates that

there is a 2% probability that a given earthquake is a foreshock of an earthquake with a magnitude 1 unit higher within the next 10 days, and that

there is a 5% probability that a given earthquake is a foreshock of an earthquake with a magnitude 0.5 unit higher within the next 10 days.

