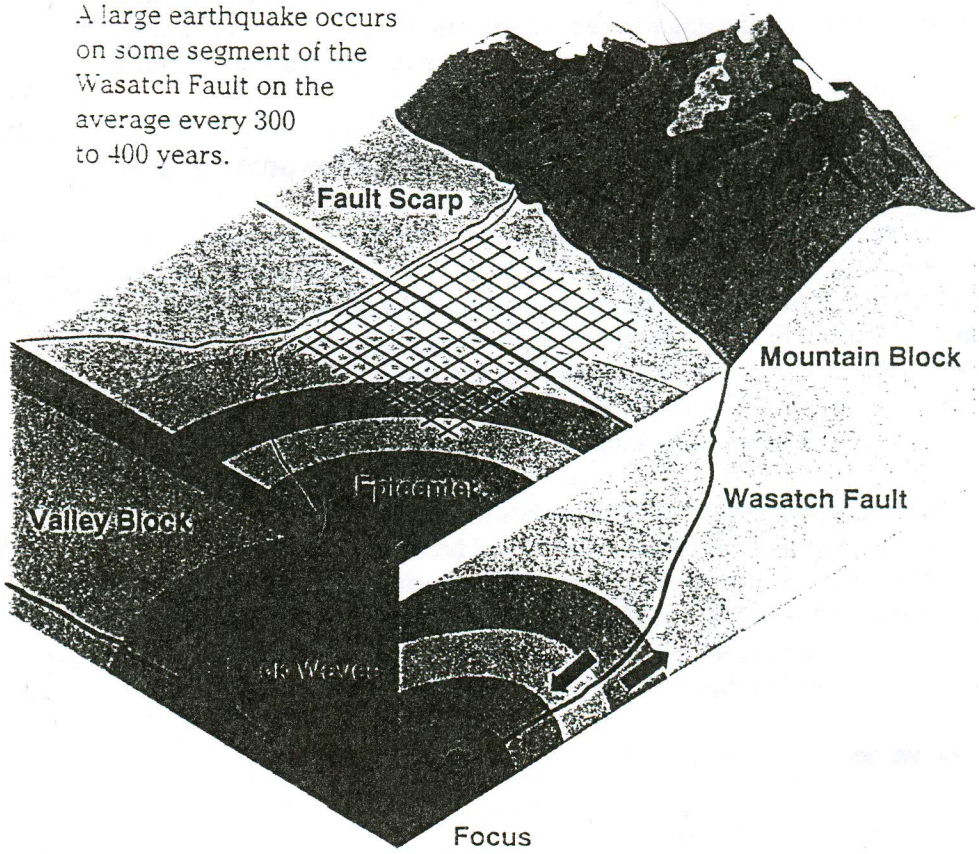
THE EARTHQUAKE HAZARD IN UTAH

Utah experiences about 700 earthquakes every year. Of this number, about 13 are Richter magnitude 3.0 or greater. Smaller magnitude earthquakes are rarely felt by people and obviously do not cause damage. However, these small rumblings are important in studying our vulnerability to larger earthquakes. Earthquakes occur on faults or cracks in the earth's crust. Utah has many active faults which could produce damaging earthquakes. For a detailed explanation of the Richter scale and other earthquake measurements, see page 19.

WHEN CAN WE EXPECT "THE BIG ONE"?

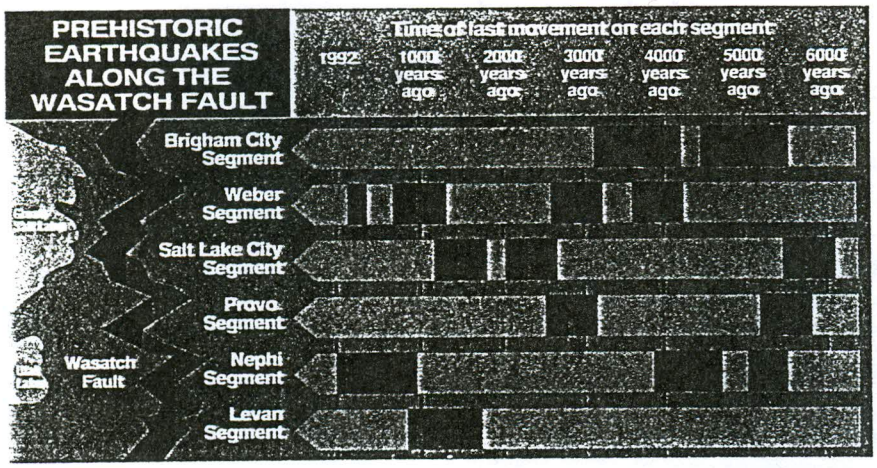
We define "The Big One" or largest expected earthquake in Utah, as about a magnitude 7.5 on the Richter scale. Young active faults capable of such a large earthquake include segments of the Wasatch Fault, the East Cache Fault near Logan, Joe's Valley Fault in Emery County, the Hurricane Fault of southwestern Utah, the Sevier Fault of southcentral Utah, and possibly others.

A large earthquake occurs on some segment of the Wasatch Fault on the average every 300 to 400 years.



WHAT IS THE PROBABILITY OF AN EARTHQUAKE IN UTAH?

The University of Utah Seismograph Stations record about 700 earthquakes each year in Utah. About 13 of these are magnitude 3.0 to 4.0. A moderate, potentially damaging earthquake (magnitude 5.5 to 6.5) occurs somewhere in Utah about every 7 years. Based on geological studies, large earthquakes (magnitude 6.5 - 7.5) occur on the Wasatch Fault of northern and central Utah about once every 400 years. The chance of a large earthquake on the Wasatch Fault during the next 50 years is about 1 in 5 (20%).



The purple line represents the best estimate on when the last major earthquake occurred. The red areas denote the earliest and the latest dates those tremors could have happened.

The 180-mile long Wasatch Fault is broken into several segments. Each segment, about 20 to 30 miles long, may produce it's own earthquake independent of other segments. The largest expected earthquake on the Wasatch should be in the **Richter magnitude** 7.5 to 7.7 range.

Several faults which appear less active than the Wasatch, may also be capable of causing a large earthquake in Utah. These include the **Hurricane Fault** in southwestern Utah, the **Sevier Fault** in southcentral Utah, the **Hansel Valley Fault** north of the Great Salt Lake, the **West Valley Fault** system in Salt Lake County, the **East Oquirrh Fault** near Tooele, the **East Cache Fault** near Logan, and the **Joe's Valley Fault** in Emery County. There are probably many unidentified faults capable of causing damaging earthquakes in Utah.

Why Earthquakes occur in Utah

The earth is a dynamic machine, a huge factory where old crust is being melted and processed into new crust and mountain belts are simultaneously being uplifted, eroded and recycled. The surface of the earth is made up of a dozen or so large plates. These plates are in continual motion like huge rafts on a sea of molten rock. This process known as **plate tectonics**, keeps in balance the awesome forces which shape the surface of the earth. As the earth moves, earthquakes are produced.

The Basin and Range which stretches from Reno, Nevada on the west, to the Wasatch on the east and includes parts of Idaho, Oregon, California, Arizona and New Mexico, is an active part of our drifting continent. This entire area is slowly being uplifted and pulled apart. As the crust of the earth stretches from west to east, cracks or **faults** appear. Portions of the area drop down along these north-south trending faults forming our

familiar long narrow valleys, while the mountain blocks remain up wedged between the dropped valley blocks.

When the extensional and gravitational forces acting on the area overcome the frictional forces holding the valley in place, we experience an earthquake. When this happens, a tremendous amount of stored up energy is released. This energy is in the form of shock waves or vibrations which radiate in all directions from the **focus** of the earthquake. The point on the ground directly above the focus is the **epicenter.**

Earthquake Measurement

Ground motion is recorded by instruments known as seismographs. The **magnitude** of an earthquake is a measure of the size of seismic waves. This magnitude is recorded on a seismograph and measured on the Richter scale. The measurement is logarithmic – each whole number increase in magnitude represents a tenfold increase in recorded ground motion. Therefore a magnitude 7 earthquake is ten times larger than a magnitude 6 and 100 times larger that a magnitude 5. As an estimate of energy, each whole number step in the magnitude scale corresponds to a release of about 31 times more energy.

Earthquake **intensity** is a measure of the damage caused by a quake: it's measured on an index known as the Mercalli scale. The Mercalli scale is based on observation. It describes effects on people and buildings at a specific location.

The **Modified Mercalli Intensity Scale** goes from I to XII. The following is an abbreviated description of the 12 levels of intensity including its rough relationship with the Richter Scale.

R	M	
2	I	NOT FELT EXCEPT BY A VERY FEW UNDER ESPECIALLY FAVORABLE CONDITIONS.
	II	FELT ONLY BY A FEW PERSONS AT REST, ESPECIALLY ON UPPER FLOORS OF BUILDINGS. DELICATELY SUSPENDED OBJECTS MAY SWING.
3	III	FELT QUITE NOTICEABLY BY PERSONS INDOORS, ESPECIALLY ON UPPER FLOORS OF BUILDINGS. MANY PEOPLE DO NOT RECOGNIZE IT AS AN EARTHQUAKE. STANDING MOTOR CARS MAY ROCK SLIGHTLY. VIBRATION SIMILAR TO THE PASSING OF A TRUCK. DURATION ESTIMATED.
	IV	FELT INDOORS BY MANY, OUTDOORS BY A FEW DURING THE DAY. AT NIGHT, SOME AWAKENED. DISHES, WINDOWS, DOORS DISTURBED; WALLS MAKE CRACKING SOUND. SENSATION LIKE A HEAVY TRUCK STRIKING BUILDING. STANDING MOTOR CARS ROCKED NOTICEABLY.
4	V	FELT BY NEARLY EVERYONE; MANY AWAKENED. SOME DISHES, WINDOWS BROKEN. UNSTABLE OBJECTS OVERTURNED. PENDULUM CLOCKS MAY STOP.
	VI	FELT BY ALL; MANY FRIGHTENED. SOME HEAVY FURNITURE MOVED; A FEW INSTANCES OF FALLEN PLASTER. DAMAGE SLIGHT.
5	VII	DAMAGE NEGLIGIBLE IN BUILDINGS OF GOOD DESIGN AND CONSTRUCTION; SLIGHT TO MODERATE IN WELL-BUILT ORDINARY STRUCTURES; CONSIDERABLE DAMAGE IN POORLY BUILT OR BADLY DESIGNED STRUCTURES; SOME CHIMNEYS BROKEN.
6	VIII	DAMAGE SLIGHT IN SPECIALLY DESIGNED STRUCTURES; CONSIDERABLE DAMAGE IN ORDINARY SUBSTANTIAL BUILDINGS WITH PARTIAL COLLAPSE. DAMAGE GREAT IN POORLY BUILT STRUCTURES. FALL OF CHIMNEYS, FACTORY STACKS, COLUMNS MONUMENTS, WALLS. HEAVY FURNITURE OVERTURNED.
7	IX	DAMAGE CONSIDERABLE IN SPECIALLY DESIGNED STRUCTURES; WELL-DESIGNED FRAME STRUCTURES THROWN OUT OF PLUMB. DAMAGE GREAT IN SUBSTANTIAL BUILDINGS, WITH PARTIAL COLLAPSE. BUILDINGS SHIFTED OFF FOUNDATIONS.
	X	SOME WELL-BUILT WOODEN STRUCTURES DESTROYED; MOST MASONRY AND FRAME STRUCTURES DESTROYED WITH FOUNDATIONS. RAILS BENT.
8	XI	FEW, IF ANY (MASONRY) STRUCTURES REMAIN STANDING. BRIDGES DESTROYED. RAILS BENT GREATLY.
	XII	DAMAGE TOTAL. LINES OF SIGHT AND LEVEL ARE DISTORTED. OBJECTS THROWN INTO THE AIR.

The relationship between Richter Magnitude and the Modified Mercalli Intensity Scale