“Breakup”

Parallel ranges and valleys dominate the landscape of the Valley of the Sun.

“Breaking up is ha-ard to-oo-oo do!” Such lines from that memorable old song with a similar-sounding name seem as timely today as when they were written. Well, OK, maybe not the “shooby-doo” parts of that same tune.

Actually however, breaking up, or breaking apart, is really not all that difficult or unusual, especially when you are talking about the ground beneath your feet. In fact, it is what is most responsible for the look of the landscape of southern and western Arizona.

Geologists divide Arizona into three basic zones or regions: the *Colorado Plateau*, the *Central Highlands*, and the *Basin and Range Province*. The Colorado Plateau is everywhere north of the Mogollon Rim, which we all climb up every time we drive to Flagstaff. And, if you draw a line from about Lake Mead, in the northwest corner of the state, down to around Wickenburg, then over towards and beyond Safford, approximately everywhere south of that line is the Basin and Range. The Central Highlands are the swath of rugged terrain that lies between the Plateau and the Basin and Range – not very wide, but cutting across almost all of Arizona – and they are kind of a mix between the two other divisions.

When driving around our part of Arizona, you may have noticed how many mountain ranges there are. None of them are really large, like the Rocky Mountains, or the Alps, but on the other hand, they are everywhere. You may have even perceived that many of them are roughly parallel to each other. This is especially visible when you drive from Phoenix over to California. You know, up and over a mountain range, across a wide valley, up and over another set of mountains, and so on, all the way to Palm Springs.

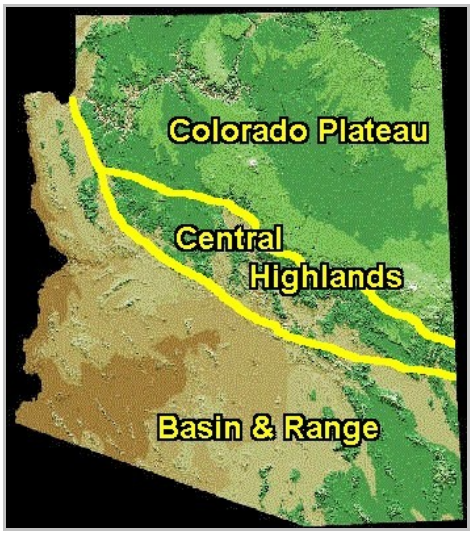
Phoenix, Tucson, and Yuma are all in the Basin and Range zone, which stretches on south into Mexico, and over to El Paso as well. Forget the fact that it is a burning desert. That is only an effect of our current climatic situation, and it has not always been so. The arid climate here has nothing to do with the basic structure of the landscape.

What you are seeing in this region is the result of a “breaking up” of the Earth’s crust. Beginning around 30 million years ago, what we now call North America began to stretch and pull apart, in a roughly northeast to southwest direction. That is because one of the major components of the planet below us is a dense, plastic, moving layer of molten rock, and we and the rocks below our feet are literally floating on top of that.

A current of hot rock, rising from the depths and spreading off to the sides, exists under Arizona (and much of the Southwest), and you could call it *a really big current*. Its surface expression runs from way out in the Pacific Ocean to up and under western Mexico and southern Arizona, and it is similar to another well-known such spreading-center which lies along the floor of the Atlantic Ocean. That one separated the Americas from Europe and Africa some 200 million years ago.

The one underneath us is causing North America to break into pieces in similar fashion – we are just in its early stages. Such activity comes under the heading of *tectonics* – the term geologists use to describe the causes of large-scale structures of the Earth.

It should come as no surprise that motion in this sense can cause earthquakes, but southern Arizona is in the oldest part of the Basin and Range Province, and so we have a very low earthquake, or seismic, potential. Rest easy. The bumpy parts of the ride are mostly over with for us.



Arizona's three main geologic provinces.

In several of my older GeoStories™ about the Phoenix area, notably “Treasures in the Basement” and “Landmark”, I talked a bit about the deep basins and mountain groups within our metro area.

However, that geologic situation is not limited to just here. It exists all across the Southwest; even up into Nevada and Utah – valleys and mountains, basins and ranges, running in more or less parallel fashion. The valleys look so flat because they have eventually filled in with sand, gravel, salt beds and such.

The *Sierra Estrella*, southwest of Phoenix, are one striking example of a Basin & Range set of mountains.

For the most part (leaving out some volcanic and other activity), the mountains around us are not here because they have been pushed up (like the above-mentioned Rockies and Alps, among others), but because Earth's crust has been pulling apart, and is still breaking up, with the valleys settling down, along big fractures we call *faults*.

The higher chunks of crust left standing have weathered and formed into the jagged mountains we now see. Geologists have a name for this type of stretching motion. It is called *extensional tectonics*.

Try naming a song after that!

To learn more about Arizona's amazing geology and archaeology, visit **www.gemland.com**, go to the "GeoScenery" section, and click on any name on the map. That will initiate a series of images, together with geologic explanations, and you can even send any picture you like to your friends as an E-postcard for FREE!

----- *Richard Allen*
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