Geology of the Abiquiu Area

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Much of the beauty of northern New Mexico relates to the intersection of 3 physiogeographic provinces of the American Southwest: the Colorado Plateau, the Rocky Mountains, and the Rio Grande Rift. The Colorado Plateau in northern New Mexico is characterized by high plateaus of colorful sedimentary strata that were originally deposited in the Four Corners region between 300-75 million years ago, when most of the land was at, or near, sea level. Subsequent tectonic compression, beginning at ~75 million years ago, resulted in the uplift of the entire plateau, in places rising former ocean deposits over two miles in elevation. These tectonic forces, mostly due to the collision of two tectonic plates between 75 – 40 million years ago (the North American and Farallon plates) also caused the crust peripheral to the Colorado Plateau to uplift and deform, resulting in the formation of the Rockies.

In the past 30 million years, however, this great tectonic compression has yielded to extensional (pulling apart) tectonics in the southwest, creating a new geologic feature in New Mexico termed the Rio Grande Rift. In essence, the western half of New Mexico has "rifted" apart from eastern New Mexico, creating a north-south sequence of downdropping basins (e.g. Taos and Española basins), allowing sediments to accumulate within these basins over time, and eventually leading to the development of the Rio Grande drainage system extending into Colorado. Another consequence of New Mexico rifting apart is widespread volcanic activity. Tearing of the crust in the Rio Grande Rift has allowed magma, both from the mantle and the crust, to find access to the surface, resulting in a myriad of volcanic eruptions in the past 30 million years. A weaker tear in New Mexico's crust, termed the Jemez Lineament, has also resulted in numerous volcanic eruptions in the past 9 million years. The Jemez Mountains reside where these two crustal tears overlap.

The rocks exposed in the Abiquiu region span a time range of approximately 300 million years and include a variety of sedimentary and volcanic rocks. Several geologic periods are represented by these deposits, including (from oldest to youngest) the Permian, Triassic, Jurassic, Cretaceous, Tertiary (Paleogene and Neogene), and Quaternary. The rock units represented on the geologic map tell a story of a dynamic, changing landscape through geologic time. The geologic map includes 7 main sedimentary units and 4 volcanic units, and includes a simple description for each unit. The Geology Timeline diagram shows the approximate age span for each unit on the geologic map. Note that there are several gaps on the time scale with no corresponding rock unit. These missing time gaps, termed *unconformities*, indicate that no strata are preserved in the Abiquiu region during these periods. They could represent extended periods of erosion, periods of deposition and subsequent erosion, or stagnant periods when neither deposition or erosion were taking place. One of the greatest unconformities, ~65 million years, is the missing gap between the Permian Cutler Group (290-300 million years ago) and the overlying Triassic Chinle Group (225-215 million years ago).

Rock Units for the Abiquiu Geologic Map

Volcanic Rocks

Qbt – Quaternary Bandelier Tuff. 1.6 and 1.25 million years ago. Pinkish-orange pyroclastic flow deposits from the Toledo (1.6 Mya) and Valles (1.25 Mya) caldera eruptions.

Tv1 – Tertiary El Alto basalt. ~2.8 million years ago. Basalt lava erupted from a fissure vent along the eastern base of Polvadera Peak. Capping lava of Mesa de Abiquiu.

Tv2 – Tertiary volcanic rocks. 10-3 million years ago. Wide variety of lavas from the Jemez Volcanic Field. Also, ~5 million year old basalt capping Sierra Negra.

Sedimentary Rocks

Ts1 – Tertiary Rio Grande Rift sediments of the Tesuque Formation. 20-8 million years ago. Pinkish-orange sandstones, siltstones, and mud mostly deposited by rivers coming off the Sangre de Cristo Mountains. Includes sand dune deposits of the Ojo Caliente member (13-10 million years ago).

Ts2 – Tertiary Rio Grande Rift sediments of the Ritito and Abiquiu Formations. 29-20 million years ago. The Ritito Formation is an alluvial fan conglomerate and sandstone deposited between 29-26 million years ago and represents the oldest rift deposit. The overlying Abiquiu Formation is a white to beige alluvial sandstone deposited between 25-20 million years ago. Ash, crystals, and pumices from a massive supervolcano eruption north of Taos (Questa caldera) provided much of the source material for these river deposits.

Ts3 – Tertiary Rocky Mountain sediments of the El Rito Formation. 45-35 million years ago. These red conglomerate and sandstone deposits originated from the Tusas Mountains north of Abiquiu and were deposited during a period of great compression and uplift of New Mexico.

Ks – Cretaceous sediments of Burro Canyon and Dakota Formations. 115-90 million years ago. The Burro Canyon Formation sediments represent coastal braided stream deposits. The overlying Dakota Formation represents marine sandstones and shales from the transgressing Cretaceous Seaway.

Js – Jurassic sediments of the Entrada, Todilto, Summerville, and Morrison Formations. 165-150 million years ago. This sequence of sediments represent ancient sand dunes (Entrada), a shallow sea evaporite (Todilto), more rivers and sand dunes (Summerville), and capped by river floodplain deposits (Morrison).

TRs – Triassic sediments of the Chinle Group. 225-205 million years ago. This sequence of sediments includes several sandstone and shale units representing large river systems meandering across a broad floodplain. Remarkable fossils of *Coelophysis*, one of the first dinosaurs, are preserved near Ghost Ranch in the uppermost unit, the Petrified Forest Formation.

Ps – Permian sediments of the Cutler Group. 300-290 million years ago. Red sandstone and shale deposits that contain abundant fossils of plants, amphibians, and early reptiles. Deposited during the time of the supercontinent Pangea.

Rock Units

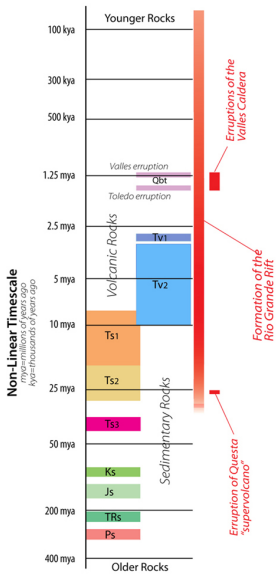
Volcanic Units

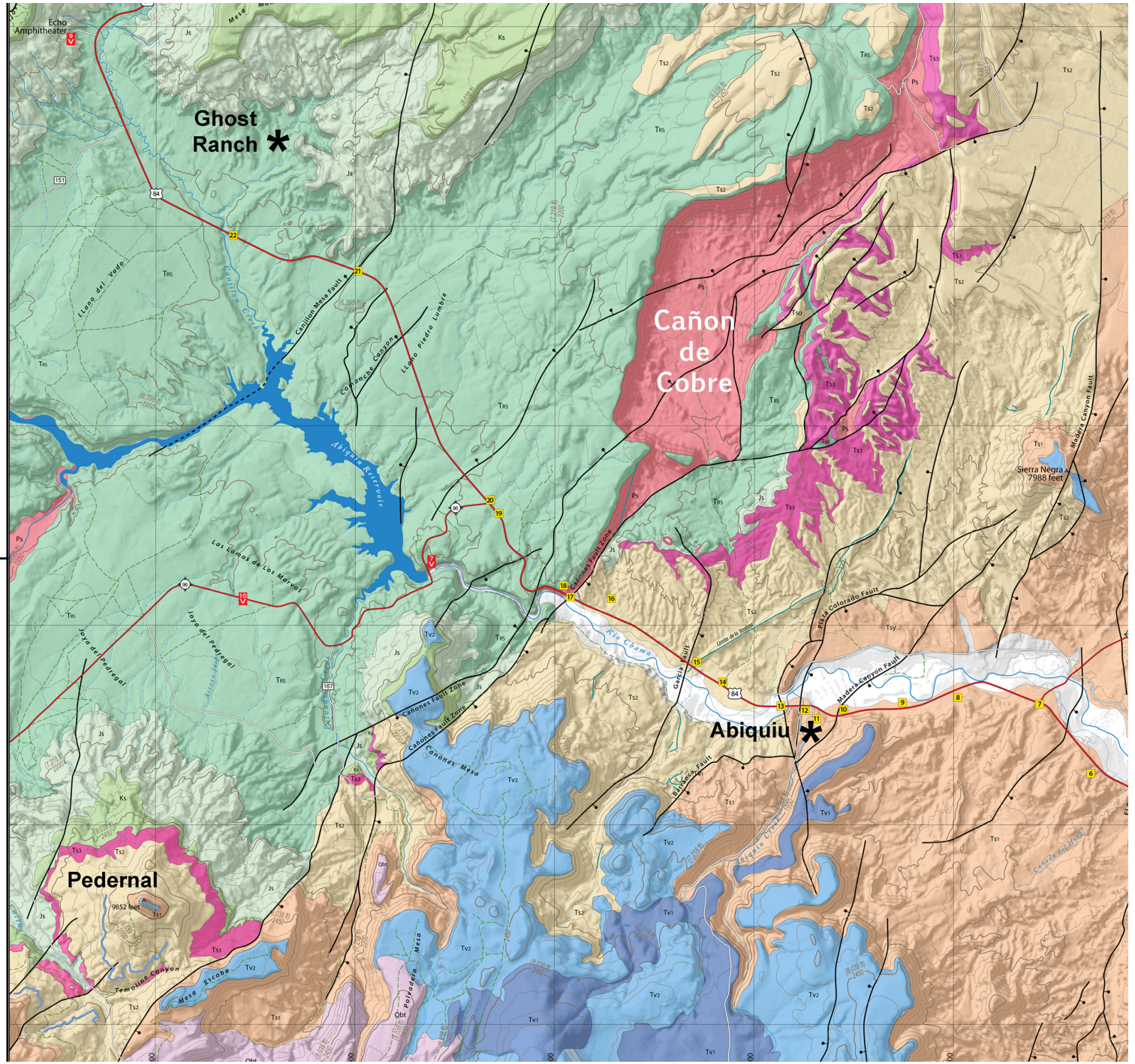
Qbt	**Quaternary Bandelier Tuff**	*1.25 Mya*
Tv1	**Tertiary El Alto Basalt**	*2.9 Mya*
Tv2	**Tertiary Jemez Volcanics**	*~10 to 3 Mya*

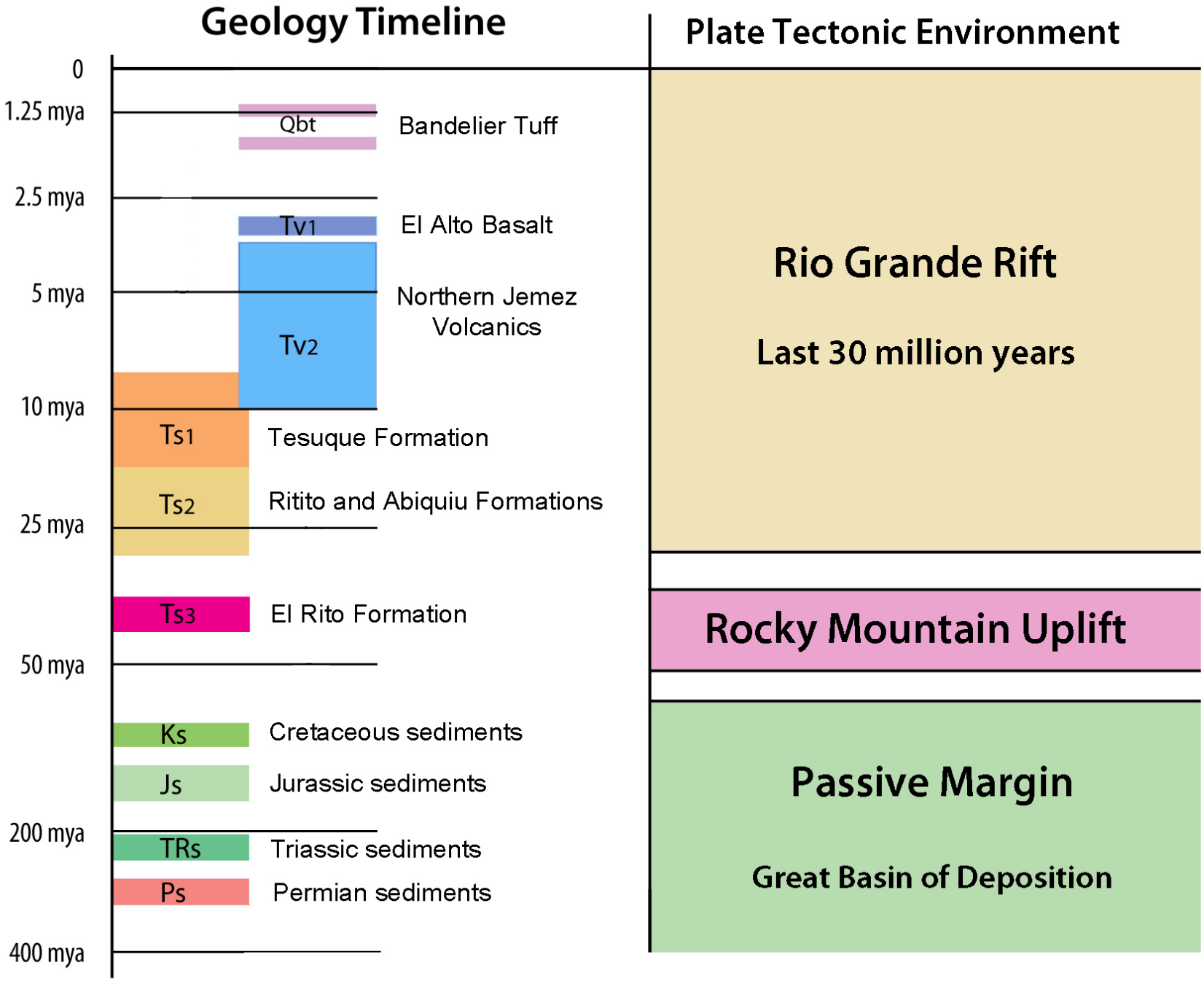
Sedimentary Units

Ts1	**Tertiary Rift Sediments**	*~20 to 8 Mya*
Ts2	**Tertiary Rift Sediments**	*~28 to 22 Mya*
Ts3	**Tertiary El Rito Formation**	*~45 to 35 Mya*
Ks	**Cretaceous Sediments**	*~125 to 90 Mya*
Js	**Jurassic Sediments**	*~165 to 150 Mya*
TRs	**Triassic Sediments**	*~225 to 205 Mya*
Ps	**Permian Sediments**	*~300 to 290 Mya*

Geology Timeline






Geology Timeline
Plate Tectonic Environment
0
1.25 mya
2.5 mya
5 mya
10 mya
25 mya
50 mya
200 mya
400 mya
Qbt
Bandelier Tuff
Tv1
El Alto Basalt
Tv2
Northern Jemez Volcanics
Ts1
Tesuque Formation
Ts2
Ritito and Abiquiu Formations
Ts3
El Rito Formation
Ks
Cretaceous sediments
Js
Jurassic sediments
TRs
Triassic sediments
Ps
Permian sediments
Rio Grande Rift
Last 30 million years
Rocky Mountain Uplift
Passive Margin
Great Basin of Deposition