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GEOL 1110-001 Final Project

Geologic Formations of Joshua Tree National Park

Figure 1. Climber on So High, Real Hidden Valley, Joshua Tree (In Defense of Joshua Tree, 2014)

Scattered across Joshua Tree you'll find tan Jumbo boulders that emerged stacked on top of one another emerging from the ground. Due to their sheer number, massive height, and bold features, these stones make Joshua Tree a globally known spot for climbers. Currently over six thousand climbing routes have been established at the park (Joshua Tree National Park Climbing, 2020). This brochure will explain how these rocks that climbers love got where they are today.

Figure 2.
Along Park Boulevard
(*Geology And Ecology Of Joshua Tree National Park*, n.d.)

The Park

Blended deserts, bold climates, and twisted flora. Named after the iconic plant prominent to its domain, this is what you'll find at Joshua Tree National Park. Located in the dry southeastern region of California, Joshua Tree is over 790,000 acres of desert landscape split between areas of high-altitude Mojave Desert and low Colorado desert. Originally a home for indigenous peoples and later in the 20th century a mining area to harvest gold and silver, it's now a popular spot for desert scenery, camping, and rock climbing (Joshua Tree Basic Information, 2020) (Dilsaver, 2015).

As early as 1.7 billion years ago during the Proterozoic era, a combination of four types of metamorphic rocks and at least five types of igneous rocks which intruded the metamorphic geology began to emerge in the ground below present day Joshua Tree (Trent, 1998). Two rocks are responsible for most formations visible at the park. One is a plutonic intrusion, the White Tank Monzogranite, formed during the Cretaceous period (Trent, 1998). The second rock is Pinto Gneiss, a pre-Cambrian "metamorphic-igneous complex" (Miller, 1938, p. 424), named from the Pinto Mountains in which it is predominantly found.

Ancient Geology

Figure 3. Geologic column showing major geologic events and rock units of Joshua Tree National Park (Trent, 1998, p. 7)

TIME UNITS			ROCK UNITS	GEOLOGIC EVENTS
Era	Period	Epoch		
Cenozoic	Quaternary	Holocene	Alluvium, talus, playa lake sediments, dune sands	Weathering, erosion, mass wasting
		Pleistocene	Basaltic flows	Volcanism, faulting, uplift, weathering, erosion, mass wasting
	Tertiary		Basaltic flows	Volcanism, faulting, uplift, weathering, erosion, mass wasting
Mesozoic	Cretaceous		Gold Park diorite Oasis monzogranite White Tank monzogranite Queen Mountain monzogranite	Intrusions and orogeny
	Jurassic		(no record)	Orogeny?
	Triassic		Twentynine Palms porphyritic quartz monzonite	Intrusion
Paleozoic	(no record)			
Proterozoic	Z		(no record)	
	Y		Anorthosite-syenite complex (1.2 billion ybp)	
	X	Eagle Mountains Assemblage: Includes the metasedimentary suite of Placer Canyon and granitic augen gneiss of Joshua Tree (1.65-1.70 billion ybp); complex suites of metasedimentary and metaigneous rocks.	Hexie Mountains Assemblage: Augen gneiss of Monument Mountain (1.65-1.68 billion ybp); metamorphosed gabbro, diorite, and amphibolite (1.4-1.71 billion ybp); metasedimentary suite of Pinkham Canyon; suite of metasedimentary and metamorphic rocks.	Tectonic episodes involving metamorphism and plutonism, probably resulting from plate interactions along the western edge of the North American landmass.

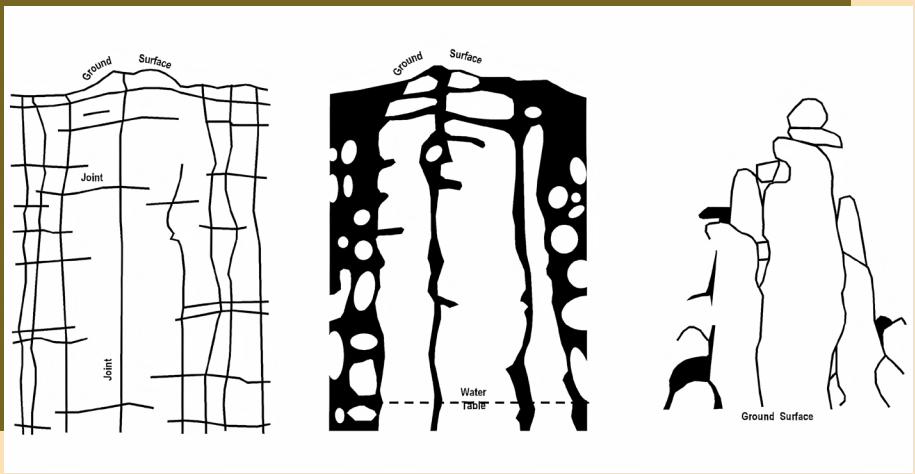

Figure 4. Diagram showing the process of jointing and erosion (Geologic Formations Joshua Tree, 2017)

Weathering & Erosion

As time passes, erosion begins to wear away at the top layers of rock and multiple processes begin to occur that uniquely shapes the rock. First, as weight is slowly removed at the surface, the land begins to rise and erosion exposes the much harder rocks (Monzogranite and Pinto Gneiss) that were deep beneath the surface (Dilsaver, 2015). Additionally, the monzogranite begins to stretch out and form vertical and horizontal joints, cracks where no displacement occurs, which outline rectangular blocks. While the monzogranite is still below the surface, ground water flows within these joints and reacts with the rock to form clay. The clay is much softer than its parent rock and is easily eroded. This causes rounding of the before they even reach the surface (Joshua Tree National Park Geology, 2020). In combination, these processes result in the striking desert formations we see currently. The next time you find yourself climbing in Joshua tree, consider the millions of years of geological action that molded the rock you're grabbing today.

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