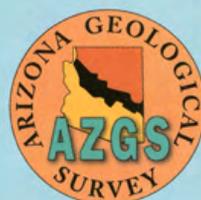


# *A Guide to the Geology of* **Catalina** **STATE PARK**

*and the Western  
Santa Catalina Mountains*

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Down-to-Earth 12*



## General Geology

The Santa Catalina Mountains and the adjacent Oro Valley, Tucson, and San Pedro basins are typical of the topography that dominates much of western North America from central Mexico to Oregon. East-west stretching of this part of the continent between 25 and 5 million years ago caused the Earth's crust to thin and break along faults (cracks) into long, north-and northwest-trending blocks. Some of these blocks were uplifted to form mountain ranges, such as the Santa Catalinas; other blocks were down-dropped to produce the adjacent basins. Geologists, therefore, refer to this vast region as the **Basin and Range** geologic province.

The Santa Catalina Range is bordered by **normal faults**—deep, steeply sloping (30–70 degrees from the horizontal) cracks in the Earth's crust along which movement, primarily vertical, has occurred. This western side of the range is bounded by the Pirate Fault (Map B), which lies at the base of the mountain front and is inclined 50 to 55 degrees from the horizontal. Rocks west of this fault dropped an estimated 10,000 to 13,000 feet (about 3,000 to 4,000 meters) relative to those in the Santa Catalinas east of the fault. Geologic evidence indicates there has been no movement along the Pirate Fault in the last 5 million years.

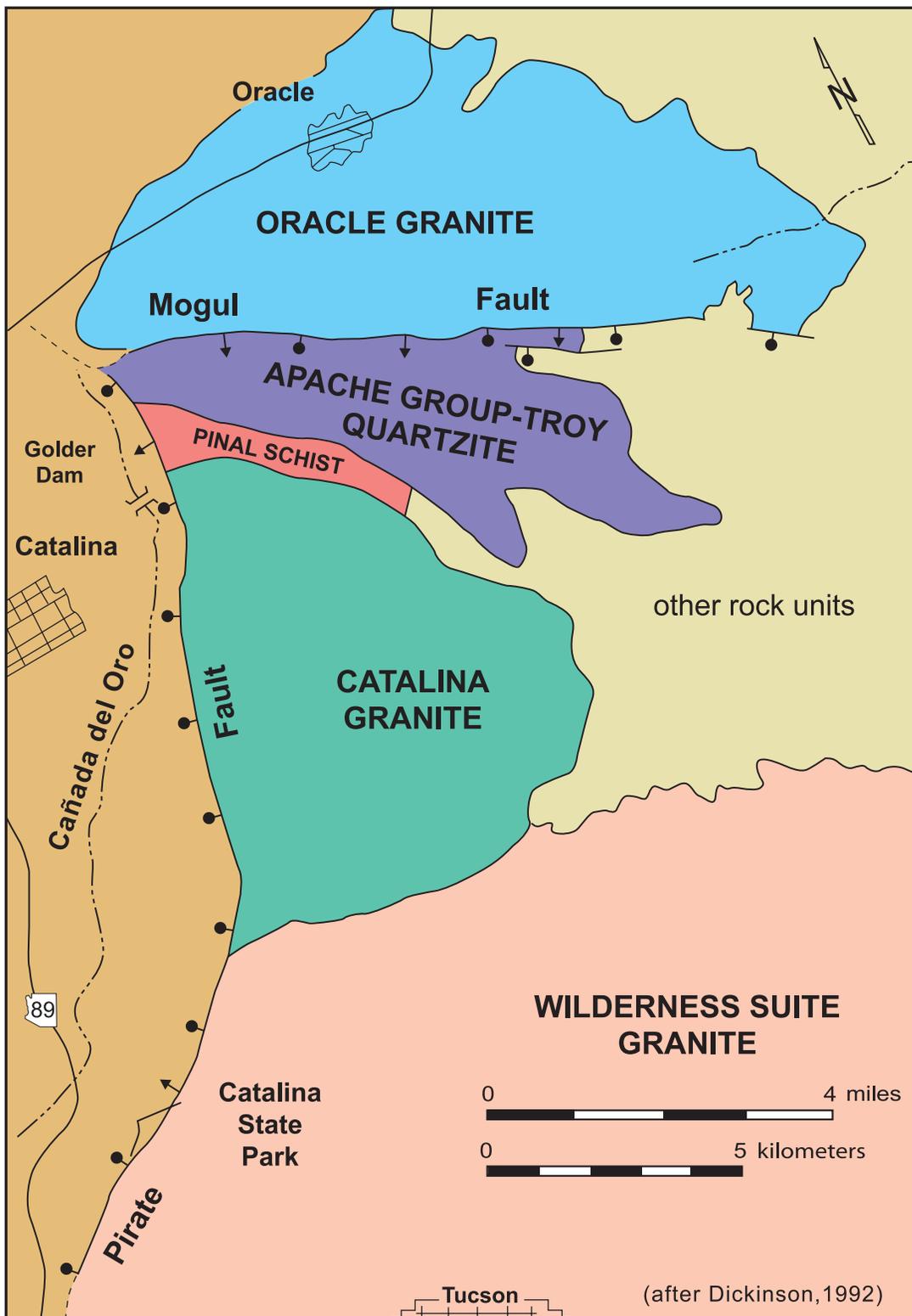
The bedrock of this part of the Santa Catalina Mountains is mainly the Oracle, Catalina, and Wilderness Suite granites. These granites were injected deep within the Earth's crust as great molten masses. They were emplaced at different times: the Oracle Granite 1.45 billion years ago, and the Wilderness Suite Granite 45–50 million years ago, and the Catalina Granite 26 million years ago. The molten rock, which cooled and solidified over millions of years and miles below the Earth's surface, has since been exposed by erosion.

These three granites have weathered and eroded into very different landscapes. Each landscape is a unique combination of landforms, which have developed in many cases because of differences in the hardness and fracture (joint) patterns of the bedrock. Many of the geologic features described in this guide are granitic landforms, some massive and others small-scale, that together make up these distinctive landscapes.

Erosion was wearing back the western face of the Santa Catalina Mountains even as the range was being uplifted. Between two and six million years ago the headwaters of streams carved embayments (drainage basins) into the mountain front and planed off bedrock platforms, called **pediments** (see Feature 12; Figure 12.1), that slope toward the Cañada del Oro. Later, these pediments were buried by **alluvial fans**—great, fan-shaped aprons of rock debris that were deposited by streams draining the retreating mountain front. By one million years ago these fans had merged with fans that built out from the eastern slopes of the Tortolita Mountains and filled the Cañada del Oro Basin with sediment.

About one million years ago today's landscape began to take its present form. Throughout much of southern Arizona rivers were extending their headwaters into higher basins that previously had no outlets to the sea. These expanding streams removed much of the sedimentary fill and altered and integrated the drainage of the basins they invaded.

These processes produced particularly dramatic results in the Cañada del Oro Basin. Prior to this time the Cañada del Oro exited the heart of the Santa Catalina



### MAP B

Geology of the western Santa Catalina Mountains

Mountains near the present town of Oracle and drained to the northwest. A more rapidly expanding stream, eroding along the shattered rock zone of the Pirate Fault, began to extend its headwaters northward from the Tucson Basin. This new stream cut its valley through the alluvial fan sediment that filled this part of the basin and re-exposed the older pediments along the western margin of the Santa Catalina Mountains. In time, this stream intercepted the ancestral Cañada del Oro and caused it to flow south.

The newly formed Cañada del Oro underwent at least four major episodes of down-cutting and left remnants of its former floodplains as part of today's landscape. Called **stream terraces**, these stepped surfaces range in age from 500,000–4,000 years.

The present landscape is a mosaic of exhumed pediments, stream terraces, remnants of alluvial fans, and the embayed front of the range—all produced over a span of at least five million years. These are typical features of the Tucson Basin and the much larger Basin and Range province of the western United States. Adding to the complexity of this landscape is the array of smaller, less widespread landforms developed on the surfaces of pediments cut into the Wilderness Suite, Oracle, and Catalina granites.