EXTRUSIVE ROCK BODIES

Extrusive igneous rocks are those which form from magma being extruded onto the Earth's surface by volcanic eruptions. The rocks include lava flows and volcanic ash. Volcanic eruptions are among the most spectacular of all geologic processes. Today more than 500 active volcanoes testify to the continuing dynamics of the Earth. Moreover, they provide an important window to the planet's interior and shed light on the processes operating in the lower crust and upper mantle.

The two major types of magma, basaltic and silicic (granitic), produce contrasting types of eruptions and form different types of extrusive rocks.

1. Basaltic magmas are low in silica and are relatively fluid. Dissolved gases escape readily, so the lava is typically extruded quietly from fissures and fractures. Fissure eruptions produce a succession of thin lava flows that cover large areas.
2. Silicic magmas are thick and viscous. The escape of gas is thus retarded, and pressure builds up within the magma. These eruptions are typically violent, and the lava is extruded as thick flows, bulbous domes, or ash flows.

INTRUSIVE ROCK BODIES

Intrusions are masses of igneous rock formed when magma cools beneath the surface. Although we can never observe these rocks as they are being formed, segments of the Earth's crust that have been uplifted and eroded have exposed them for study. The following evidences indicate that these rock bodies were once in a molten, magmatic state.

1. Intrusive rocks are characterized by a group of high-temperature minerals similar to those that form volcanic rocks. Their grain sizes are much larger, however, and this suggests slow cooling.
2. The mineral grains typically are smaller near the boundary with the surrounding rock. Their size suggests that cooling was more rapid near the margins than in the interior of the intrusion.
3. Tongues and stringers of intrusive rock fill fractures in the surrounding rock. These suggest that the rock was once liquid and was squeezed into surrounding cracks.
4. Fragments of the surrounding rock are commonly included in the intrusive mass, a feature that is difficult to explain if the rock body had not been liquid at one time.
5. Rocks that are adjacent to an intrusion are commonly recrystallized in a group of new higher-temperature minerals, which require an input of heat for their formation.

Magma rises because it is less dense than the surrounding rocks. It can be intruded by forceful injection into fractures, or it can melt and assimilate the rock it invades.

Intrusions usually are classified according to their sizes, shapes, and relationships to the older rocks that surround them (Figure 5.15). They include batholiths, stocks, dikes, sills, and laccoliths.

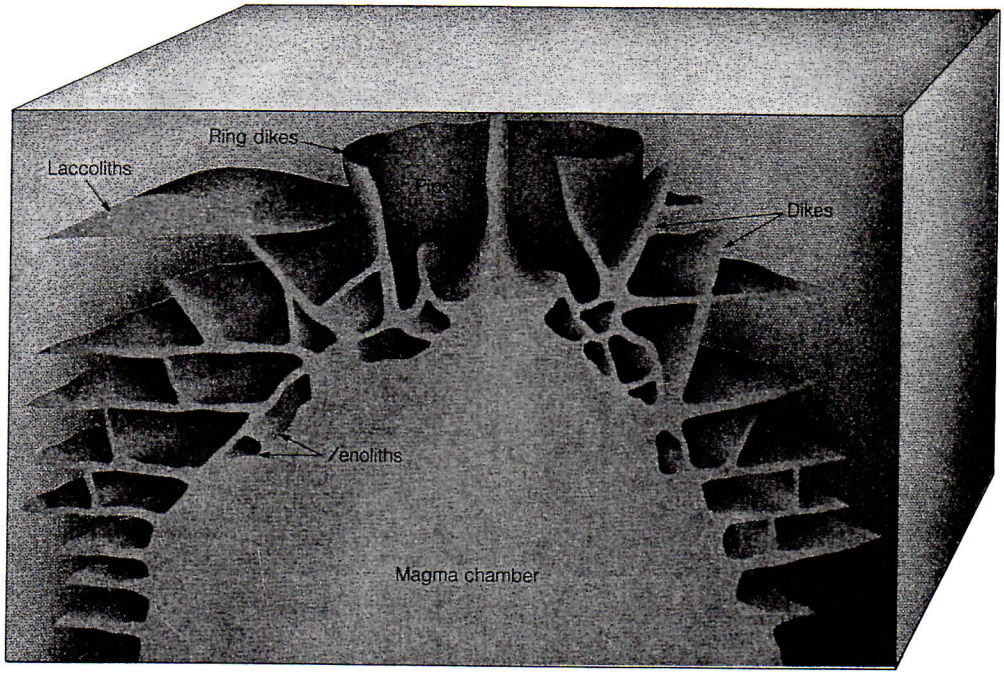

Figure 5.15
Magmatic intrusions may assume a variety of forms. Batholiths are large masses of coarsely crystalline rock that cools in the major magma chamber. Stocks are smaller masses and may be protrusions from a batholith. Dikes are narrow, tabular bodies formed as magma is squeezed into fractures and cools. Many dikes are related to conduits leading to volcanoes. Some radiate out from the volcanic neck; others form a circular pattern above a stock and are called ring dikes. Sills are layers of igneous rock squeezed in between sedimentary strata. Laccoliths, dome-shaped bodies with a flat floor, are formed where magma is able to arch up the overlying strata. Inclusions of the surrounding rock in the magma are called xenoliths. A pipe is a tabular conduit through which magma migrates upward.

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