Dike Patterns at Spanish Peaks, Colorado

Spanish Peaks region

The Spanish Peaks region of south-central Colorado is blessed with intrusive rocks of nearly every variety geologists have imagined: dikes, sills, stocks, plugs, laccoliths, and sole injections; granites, syenites, diorites, and gabbros (4). Certainly the most impressive form of intrusive in the Spanish Peaks region, however, is the dike. Dikes are so conspicuous there that F. V. Hayden noticed them in 1869 during one of his whirlwind tours which formed part of the famous Hayden Survey of the western United States (4). The dikes were studied by R. C. Hills (2) at about the turn of the century and later by Adolf Knopf (5), whose detailed petrographic descriptions of the rock types led to his famous discussion of the "lamprophyre concept."

The Spanish Peaks area is a high plain, gradually rising westward and punctuated here and there by large igneous masses that project above the plain to form Dike Mountain and the Spanish Peaks themselves. Long walls and ridges formed by dikes radiate much as spokes of wheels around hubs formed by Spanish Peaks and Dike Mountain.

The widths of the dikes range from one foot to about 100 feet. Some of them extend for 14 miles. They usually fill joints and in some places several dikes fill the same joint. Most of the dikes are vertical or nearly so (*4*).

The regional structure of the Spanish Peaks area is dominated by La Veta syncline, an asymmetric trough trending roughly north-south and passing beneath West Peak and Dike Mountain (Fig. 11.1). The eastern side of the synclinal trough dips gently and the western side dips steeply and is overturned in a few places. Immediately west of the trough are the Sangre de Cristo Mountains, which have been thrusted eastward along faults that generally parallel the axis of La Veta syncline (Fig. 11.1). Normal faults are uncommon in the area (*3,4*).

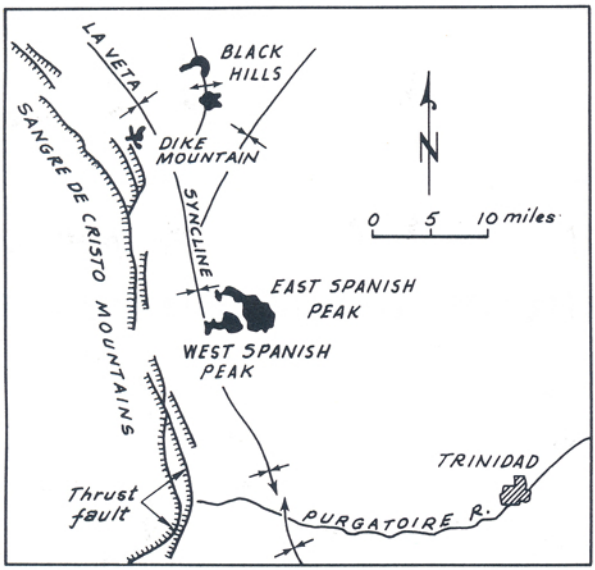

Figure 11.1. Spanish Peaks area, Colorado (after ref. *3*, p. 580).

Conglomerates and sandstones in the Spanish Peaks region are highly jointed. The dominant joint system strikes roughly east, normal to the axis of La Veta syncline, but other systems have strikes ranging around the compass. The highly jointed rocks occur all around Spanish Peaks for distances up to ten miles east of the peaks and three miles west of the peaks. Older shales and limestones, which are exposed on the limbs of La Veta syncline, beyond the limits of the sandstone outcrops, display no well-developed joints (*3,4*).

The dikes associated with the Spanish Peaks and with Dike Mountain are essentially restricted to the jointed sandstone; few dikes invaded the shales (*3,4,5*).

Dike Mountain

Stock and Radial Dike Swarm.—Dike Mountain is a stock of syenodiorite porphyry which intruded Eocene sandstones near the axis of La Veta syncline (Fig. 11.1). It has the irregular form of an ink blot and is $1\frac{1}{4}$ miles long from east to west and about one mile long from north to south (Fig. 11.2). According to Ross Johnson (*3*), there is no evidence of metamorphism or doming by intrusion of the Dike Mountain stock.

Associated with the stock is a swarm of radial dikes which radiate from a center within the stock. A few dikes actually join the rock within the stock (*3,4*). The dikes on the western side of the mountain are shorter than those on the eastern side, extending about five miles east and $2\frac{1}{2}$ miles west of the stock.

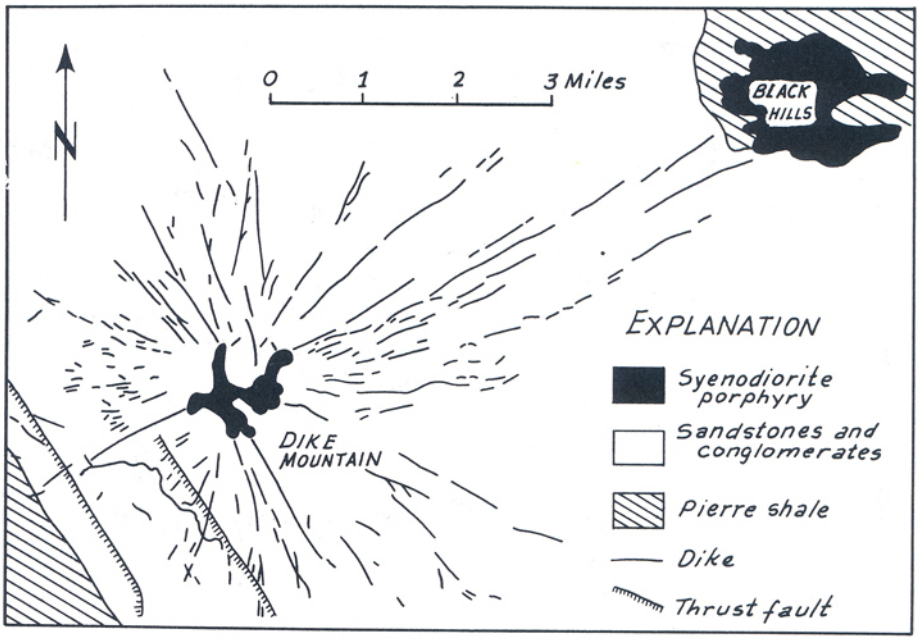

Figure 11.2. Dike swarm around Dike Mountain, Spanish Peaks area, Colorado (after ref. *3*, p. 587).

The composition of the dikes is similar to that of the stock, and for that reason Ross Johnson (*3*), who has been studying rocks of the Spanish Peaks area in detail, postulates that the dikes and the stock represent a single episode of intrusive activity, involving the same magma.

Possible Causes of Radial Dike Pattern at Dike Mountain.—About as many causes have been suggested for the dike patterns as there have been geologists studying them. R. C. Hills (*2*) suggested that the dikes occupy radial fractures produced by doming of the sandstones during intrusion of the stocks. Ross Johnson (*4*) however, reports that the sandstones were not domed. Adolf Knopf (*5*) mentioned the possibility that the dike magmas moved into joints. He suggested that the joints formed normally to the axis of La Veta syncline, as a result of tension developed by folding, prior to dike intrusion.

Johnson (*3,4*) also believed that the joints provided channels for the dikes and that the joints predated intrusion. He imagined that the joints formed throughout the region as a result of "intermittent orogenic stresses of varying directions during the folding of the La Veta syncline" (ref. *4*, p. 37). The joint pattern is complex, according to Johnson, because each of the several stress fields imposed on the rocks of the area created new families of shear and tension joints.

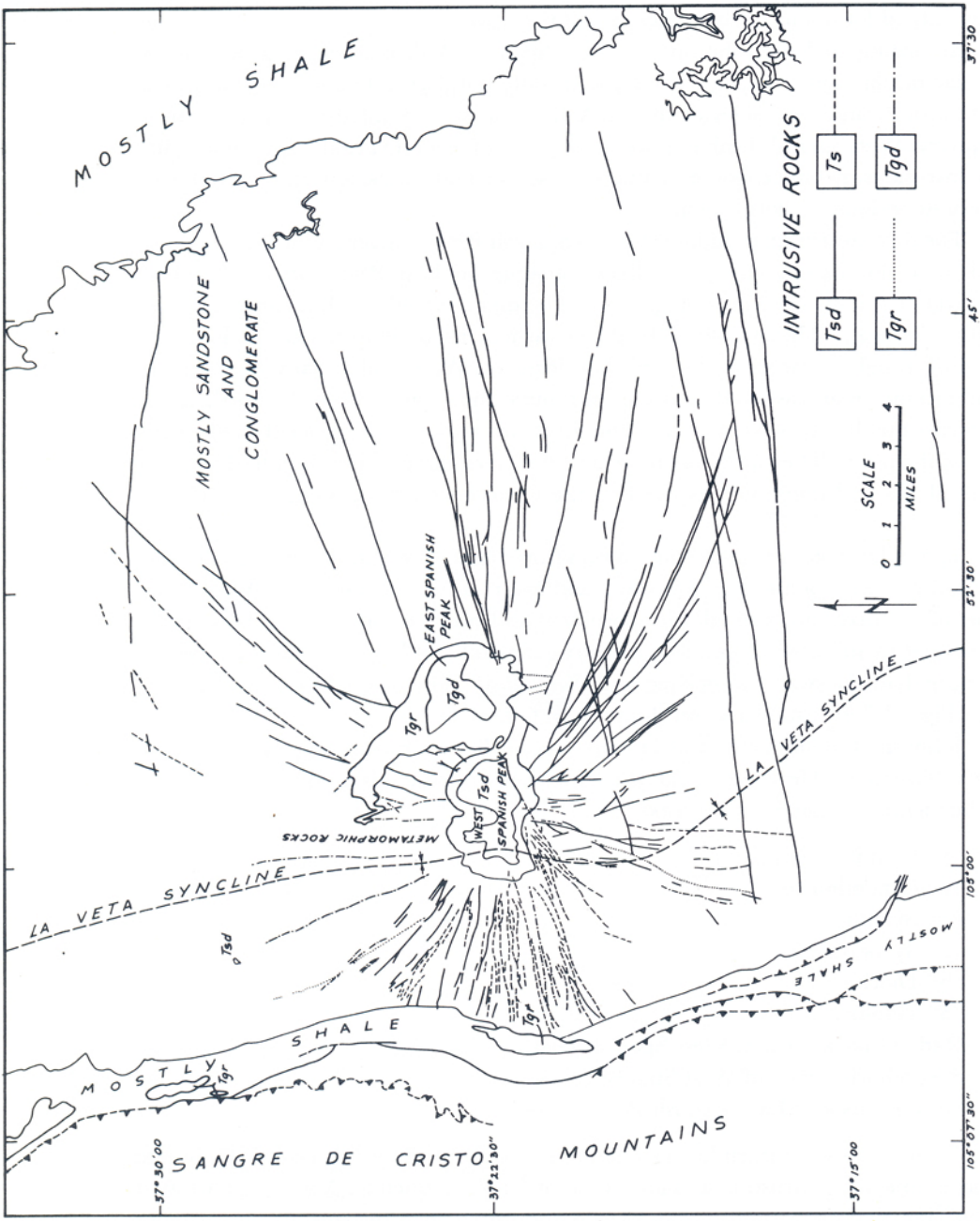

Figure 11.7. Dike swarm around East and West Spanish Peaks, Colorado (after ref. 4).