

FIGURE 5.4 Landslide activity on the NW (left) valley wall of the Quijos River just upstream (SW) from its confluence with the Salado River. The earthquake-triggered slope failures began as thin slips on the steep (45 to 50°) headwalls of the slopes, and were transformed into debris avalanches and debris flows that cascaded down the gullies onto the low terrace that forms the left bank of the river.

River to 3,560 m at the top of Reventador Volcano. The ridges on the W side of the Salado River rise to 3,600 m, and the ridges on the E reach 3,200 m; the midreaches of the Salado River valley are at an elevation of about 1,600 m. Drainage patterns are radial on the volcano slopes and dendritic or rectangular elsewhere. The rectangular pattern reflects the fracture systems that affect this region.

Reventador Volcano and related volcanic deposits constitute the most notable morphologic feature of the zone (Hall, 1977). This feature is made up of a portion of a large cone—the remains of the collapse of two ancient Reventador stratovolcanoes called Paleo Reventador I and II—that contains a smaller cone, the modern Reventador Volcano. The ancient cone resembles an amphitheater, which opens to the E toward the Coca River.

The overall slopes of the uppermost portions of the ancient cone have angles of about 30 to 35°; the slopes decrease progressively to 10° or less in the lowermost portions. The W and SW slopes of the ancient cone have two important and unique morphologic characteristics. The portion of the volcano between the headwaters of Morales Creek (a tributary of the Malo

River) and the Dué Grande River (Figure 5.1) has a dense parallel drainage pattern; long, closely spaced, parallel gullies have deeply dissected the underlying pyroclastic rocks. These gullies are from 50 to 100 m deep and have gradients that commonly are greater than 35 to 40°. The canyons of Morales Creek, the Dué Grande River, and two unnamed tributaries to the N of the Dué Grande have valley walls that reach heights of more than 200 m and have slope angles greater than 60°. The headwaters of these canyons are cirque-like and present large piping (internal-erosion) cavities in the pyroclastic beds. The valley walls of the Coca River have overall slopes generally between 30 and 40°. The top of the right valley wall, which has been eroded into quartzose sandstone of the Hollin Formation (geologic map, Figure 5.6), is almost vertical in several places. Downstream from San Rafael Falls (Figures 5.1 and 5.7), the Coca River becomes entrenched, and the walls are very steep or vertical. Gullies descending the main valley slopes of the Coca River have gradients of 45 to 60°. The valley walls of the Malo River commonly are steeper than 45°. The main valley walls of the



FIGURE 5.5 Landslides along the Trans-Ecuadorian highway 3 km W of its crossing of the Salado River. These rock falls, slides, and avalanches, which were triggered by the March 5, 1987, earthquakes, had blocked the highway almost continuously in the stretch shown in this photograph. The highway was passable at the time of this April 25, 1987, photograph because of the efforts of Corps of Engineers (Ecuadorian Army) highway maintenance crews.

Quaternary	Q _c	Cotopaxi Group (strato volcanoes) Andesites, lavas, pyroclastics
	Q _m	Mera Formation (50-200 m) Terrace deposits (conglomerates, sandstones, tuffaceous shales)
Miocene	M	Arajuo Formation (500-1000 m) Clays, sandstones, lignites
Oligocene	Θ _c	Chalcana Formation (600-1100 m) Redbed shales, gypsum
Paleocene	P _ε tu	Tiyuyacu Formation (70-550 m) Conglomerates, sandstones, redbed shales
Cretaceous	K _{ta}	Tena Formation (250-1000 m) Shales, marls (redbeds)
	K _n	Napo Formation (200-650 m) Shales, limestones, sandstones
	K _h	Hollin Formation (35-200 m) Quartzitic sandstones
Jurassic	J _c	Chapiza Formation (1000-1500 m) (including Misahualli Member: lavas, pyroclastics). Redbed sandstones and shales
?Jurassic	gp	Granite, granodiorite
lower Paleozoic	P _{za}	Ambuqui Group Schists, phyllites, quartzites
Precambrian	pC	Undifferentiated

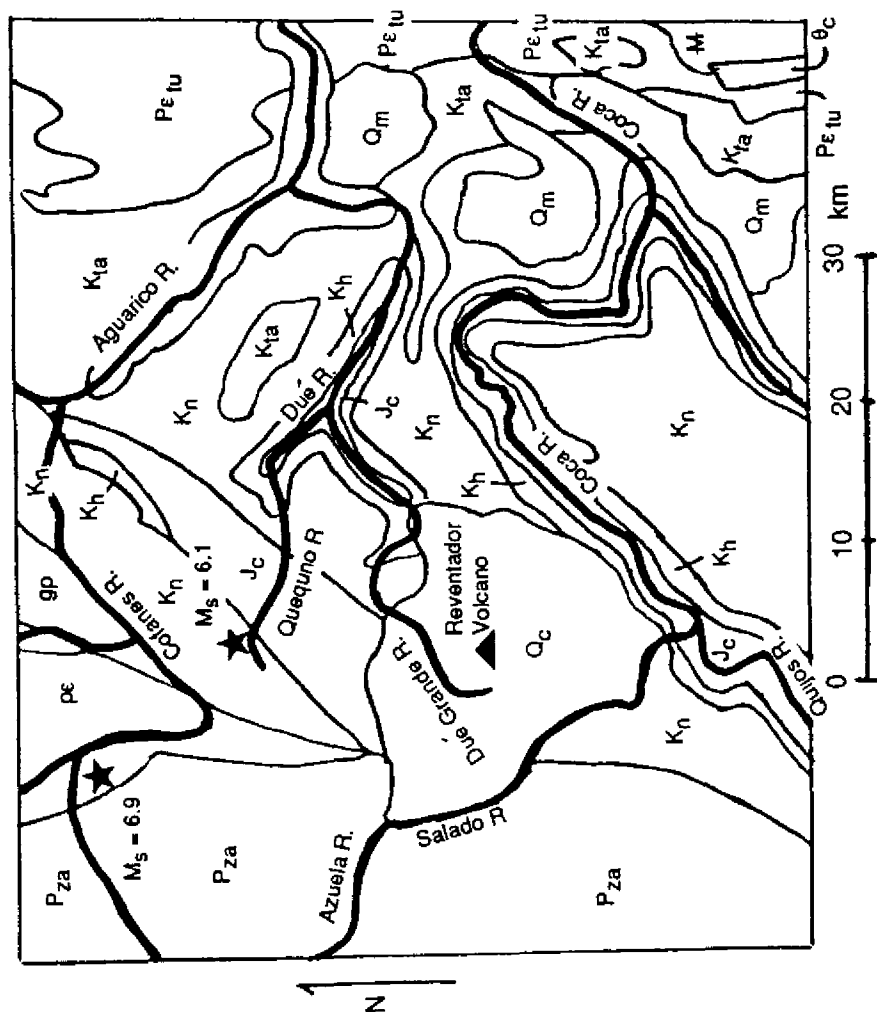


FIGURE 5.6 Geologic map of the Reventador Volcano area (modified from Baldock, 1982).