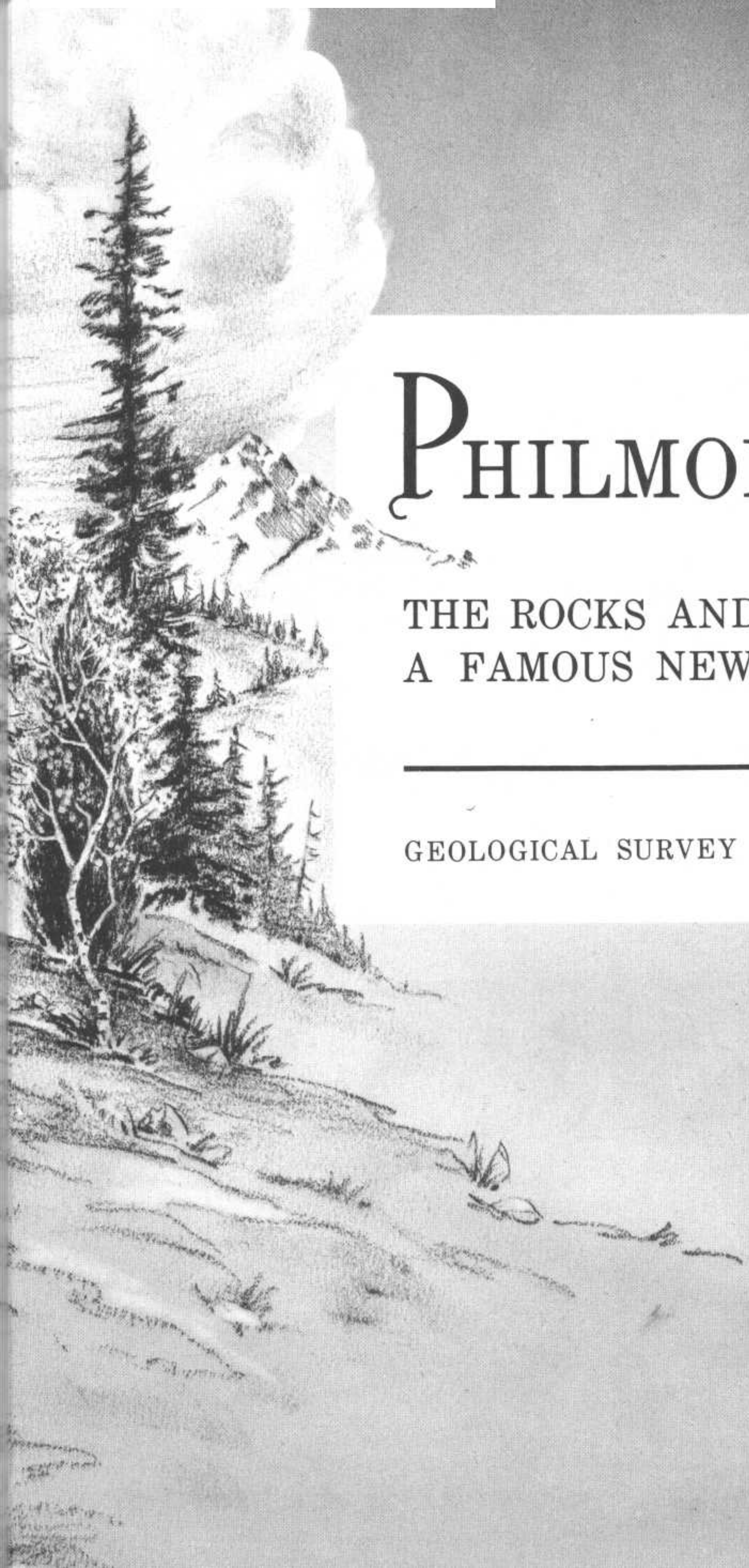

PHILMONT COUNTRY

THE ROCKS AND LANDSCAPE OF A FAMOUS NEW MEXICO RANCH

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The southernmost trail in the Philmont region follows Moras Creek upstream to the steep front of the Ocaté Mesa and then wanders across the mesa. For several miles this trail, too, crosses familiar scenery: first the lowland plain flanking Moras Creek, rising in three bench steps to rough, hummocky hillsides along the mesa front; and then a rocky bench atop the mesa. The benchland at the mesa edge is definitely darker colored than that far to the north, but the shapes are similar, if a little more rounded. Westward, however, to Rimrock Lake and beyond, the trail crosses many marshy meadowlands, like those of Bonito and Agua Fria Creeks but much broader and more irregular (fig. 12).

We have seen that the landscape can be divided into five main kinds of landforms: gravel-capped lowland plains; smooth-sided rocky benchlands; rough, hummocky hillsides; rugged mountain country; and high marshy meadowlands. These are shown on a scale model, plate 1 in the back pocket. The model is drawn as it might look to a bird hovering high above the southeast corner of Philmont. How each of these forms came to be, we will learn as our story unfolds. It is not just a matter of height above sea level, for there is much overlap in altitude among the five kinds of landforms. We can see already that the rocks beneath the land are somehow related. Before turning to the rocks, however, we must look at another major landscape feature—the water on the land.

GEOLOGICAL SURVEY STREAM-GAGING STATION on Cimarron Creek. A, Cable car used when measuring the rate and amount of water flow. B, Depth-recording gage. (Fig. 13)

Water on the land: Creeks and lakes

After a heavy rain or after the spring thaw, water runs off every slope and pours down every gully and canyon; but for long periods in summer and winter, all the gullies and most of the short canyons are dry. In the long canyons, creeks usually flow all year round, although most of the flow comes in the 4 months, April to July. After spring thaws or heavy summer rains, the main streams may for a few days discharge so much water that they overflow their banks and flood their valley floors. The rest of the year they dwindle to a trickle; sometimes they even run dry.

The details of streamflow are very important to everyone living in the area; for this is dry ranching country, and the streams are a main source of water for drinking, waste disposal, and irrigation. To measure streamflow accurately, the U.S. Geological Survey maintains stream-gaging stations on Cimarron, Rayado, and Ponil Creeks. Figure 13 shows what such stations look like. The depth of the water at each station is automatically recorded by a gage (fig. 13*B*), and the rate and amount of water flowing past the gage is measured, usually twice a month, by an observer, using a hand-powered cable car (fig. 13*A*) who makes measurements at midstream. Several thousand such stations are operated all over the United States.

The intermittent creeks get all their water from rain or melted snow. They run dry soon after a rain stops or after the snow melts. The creeks that keep flowing through dry spells have more sources of water than just that which runs off the surface. Cimarron Creek gets much of its water from Eagle Nest Lake in Moreno valley to the west; Agua Fria Creek, in the southwest corner of Philmont, is partly fed from Agua Fria Lake. The other perennial creeks, such as Ponil, Cimarroncito, Urraca, and Rayado Creeks, start from gullies on mountain sides and are fed downstream by springs that gush or seep out of the rocks.

Creeks in the high mountains run straight and swift in narrow V-shaped valleys (fig. 14). Down stream, but still in the mountains, the valley bottoms of the larger streams flatten, and the creeks flow smoothly as they wander from side to side on the valley floor (see fig. 10). Where the streams cross rocky ledges at the mountain front, their valley walls close in, and their beds become very rough, having alternate riffles, pools, and falls (fig. 15). Most of the waterfalls, like the one pictured, are only a few feet high; but one on South Fork Urraca Creek, near where the trail to Crater Lake Base Camp crosses the creek, is more than 50 feet high. As the streams leave the mountains and flow through the benchlands to the plains, rapids and falls disappear, and the streams again flow quietly, meandering on valley floors that widen downstream (fig. 16).

The perennial streams and their larger tributaries are arranged like the veins of an oak leaf or the branches on a piñon pine: where they meet, they form V's that point downstream. Even the smallest gullies have this pattern in most of Philmont; but along part of the mountain front, between Cimarroncito Creek and Ute Park Pass, the pattern of the small streams is different. There, the streams run about parallel to the mountain front and to each other.

Knowing that water flows downhill, we naturally expect the streams of Philmont to flow away from the crest of the Cimarron Range. Nearly all of them do, but not Cimarron Creek. Starting at Eagle Nest Lake in Moreno Valley, it flows right across the range. It is, therefore, by far the longest stream at Philmont and the master stream of the area. All the other streams join it in or near Philmont, and the combined flow enters the Canadian River, 20 miles to the east. Eventually, the water that flows out of Philmont ends in the Gulf of Mexico, after a 1,500-mile trip by way of the Arkansas and Mississippi Rivers.

Even the few creeks that flow westward off the map area are tributaries of Cimarron Creek.

NEAR THE HEAD OF A TYPICAL STREAM in the mountain country. (Fig. 14)

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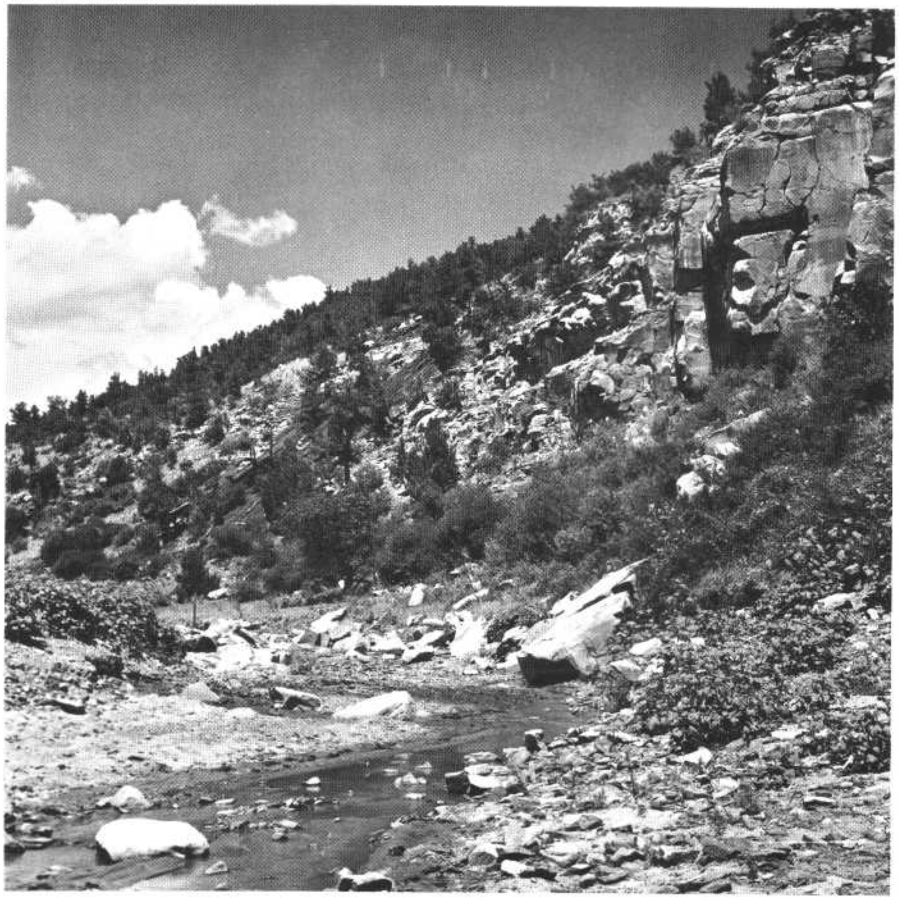
CREEK on plains east of the mou
front. (Fig. 16)



SHARP-EDGED CHUNKS OF ROCK (Trinidad Sandstone) that have recently fallen into the bed of Ponil Creek. (Fig. 18)

The creeks that drain the west flanks of Baldy Mountain, Touch-Me-Not Mountain, and Tolby Peak descend into Moreno Valley and then turn and flow into Eagle Nest Lake. From there these waters start their long eastward journey down Cimarron Creek. How Cimarron Creek came to flow across the Cimarron Range in such a roundabout course, we will go into later.

In times of flood, the creeks do more than drain the water off the land. Most of the time, Cimarron Creek, for instance, is a clear quiet stream only a foot or two deep and two jumps wide. As it flows smoothly over its gravel bed, it sweeps along only a little sand. But after a heavy rain or thaw, it swells into a swirling, roaring flood that has frightening power. The creek becomes a thick sludge of sand, mud, and plant debris. Large stones thunder and rattle as they are swept along the bottom, crashing against the stream bed and each other. Where the banks are steep, the water piles high; where they are low, the torrent leaps them and spreads into a thin turbulent sheet. As the flood recedes, we can see that the creek has cut into its banks and bed in some places, especially on the outside of wide swings, or even has cut a new channel. In other places, it drops its load—first the boulders, then the cobbles, and then the sand and mud, as the speed of the water slackens. In this way, by sidecutting here, filling there, and shifting its channel in storm after storm, the creek widens and smooths its flood plain.

Many of the stones in the creek bed have come a long way (fig. 17). Near Cimarron the creek flows between banks of soft black shale, but the stones it moves are not shale; they are mostly hard yellow or white sandstone and salt-and-pepper-spotted dacite porphyry, a rock like granite. Outcrops of yellow sandstone are nearby, but we must go to the mountain front, at least 11 miles upstream from the town, to find the creek running near ledges of dacite porphyry, and still farther to find white sandstone ledges. In the mountains, the stones start their journey as sharp-edged chunks of all sizes that break off bedrock ledges and roll or slide into the creek (fig. 18). As the chunks are moved farther downstream by flood after flood, impact with each other and with the rocky stream bed splits them into smaller and smaller pieces and rounds their edges a little.

A stream in flood is a mighty shovel, and the valley in which it runs is not just a "low place" to which water flows but rather is low because water has long flowed through it. The stream deposits show this, but their evidence is not really needed to prove that streams generally make their own valleys. Almost everywhere at Philmont and, in fact, the world over, streams join each other smoothly, having neither pools nor falls at the junction (fig. 19). If the valley of each stream were not cut by the stream itself, but were a crack in the earth's skin due, for instance, to the drying out or the upheaval of rocks, this would certainly not be so. Instead, most junctions would be marked by cliffs which, depending on whether the cliff faced upstream or downstream, would pen lakes or make waterfalls. Cracks in the earth's skin may, however, give streams a place to start. Where stream junctions are not smooth, we may suspect that other agents besides running water have been at work.

Thinking of streams in this way, and realizing their power to erode, we may well wonder that the Cimarron Range, or any mountain, stands above the sea. Where mountains remain, the streams have not finished their work, either because they have not had time enough or because processes in the earth work against erosion to keep mountains high. The geologic story of Philmont is mainly the record of interplay among the little-known processes that make mountains and the less mysterious ones, mainly stream erosion, that destroy them.

Not all the rain or melt water flows off the surface. Much of it stands in thousands of low places all over Philmont. Most of this standing water disappears within hours or days, partly by evaporating and partly by sinking into the ground. Only about 20 bodies of water are large enough and persistent enough to be thought of as lakes. Of these, only four are year-round natural lakes: Deer Lake on Deer Lake Mesa, Crater Lake at the east base of Trail Peak (fig. 20*A*), and Agua Fria and Rimrock Lakes on Ocaté Mesa (fig. 20*B*, *C*). The others, such as Webster Reservoir, Hagerdon Lake, and Miami Lake, are man made.

The lakes, whether natural and artificial, will not last long, in

TYPICAL JUNCTION of streams. (Fig. 19)

NATURAL LAKES of Philmont. A, Crater Lake. B, Agua Fria Lake. C, Rimrock Lake.
(Fig. 20)

terms of geologic time. The creeks flowing into them bring in gravel, sand, and mud; a lake, therefore, slowly disappears by filling, in from the sides and up from the bottom. When the water is low, we can see how the filling process works (fig. 21). Spreading from the mouth of each creek is a low bulging fan-shaped mass grooved by fingerlike channels. This fan-shaped mass has been dumped by the creek as it lost its speed, and therefore its ability to carry a load, when it flowed into the standing lake water. The finger-like channels mark the final path of the flowing water before it merged with the lake water. In these channels are the coarsest materials—gravel and sand. Beyond the fingers are the finer materials that could be carried farther—silt and clay. As the shape and size of the lake changes, the pattern in which creeks entering the lake spread their load changes too; so that stringers and patches of different kinds of rock waste alternate with, and grade into each other, and the lake

slowly fills. Eventually, it may become too shallow to hold the creek waters, and they will pour over the lowest point. Regaining speed because of the increased slope, they will cut away at the outlet, draining the lake and trenching the lake deposits, until the former lake becomes part of the stream valley.

Long before a lake is destroyed by filling or by overflow, however, there is a good chance that it will be destroyed by other natural enemies. It may die slowly, its rim breached by a stream from below, as in the diagram (fig. 21), or it may die quickly, its rim broken by earth movements or the failure of a dam. For instance, the topographic map shows that large but seasonal La Grulla Lake, on the edge of the Ocaté Mesa south of Rayado Base Camp, will be drained before long by the stream that has already deeply notched the nearby mesa rim.

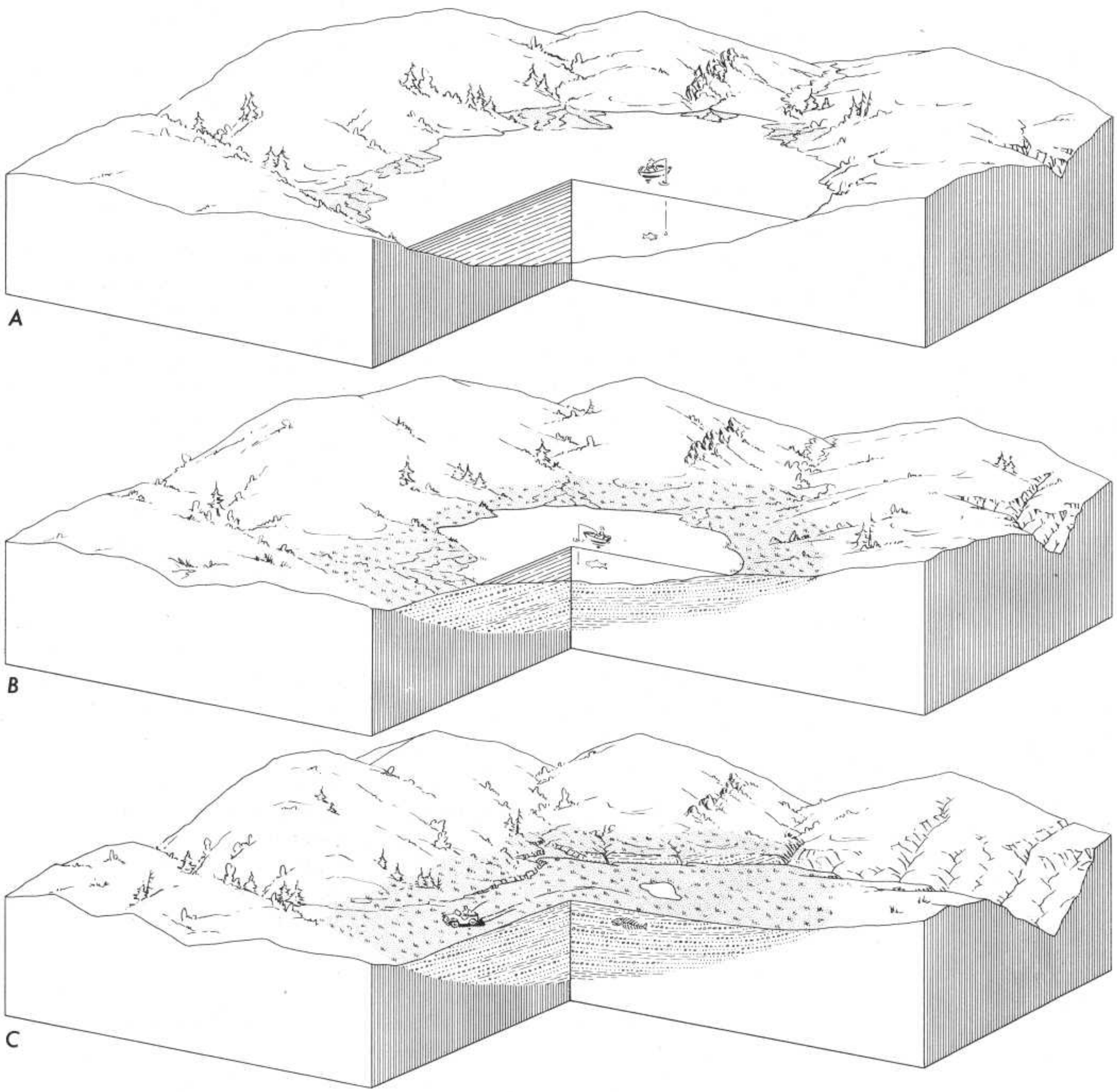
Climate

On the plains and lower mesa lands, the climate is semidesert. Most of the landscape, covered with short grasses, is a dull yellowish gray except where man has cultivated it. Scattered about the grasslands are clumps of dry-country shrubs such as cactus, greasewood, rabbit brush, sagebrush, and yucca. Almost the only trees are cottonwoods and willows, which are along streams. Cimarron, where the U.S. Weather Bureau has long had a station, has about 16 inches of rain and melted snow in an average year. This is more moisture than deserts receive, but it is not enough to insure crops without irrigation. About half the water that falls on the plains comes as afternoon rains in spring and fall. Snow falls from October through May and usually totals about 40 inches (1 foot of snow is equal to about 1 inch of rain). There are about 70 rainy or snowy days each year at Cimarron—less than 1 in 5. Though the plains are dry, they are not hot because they are more than a mile above the sea. Once in a while it gets as hot as 96°F. in midsummer, but the highest summer temperatures are generally in the 80's. Winters on the plains are cool: afternoon temperatures are in the 50°'s or 60°'s, and those at night are often below freezing but rarely below 0°F.

In the higher country the climate is markedly different. Days and nights are much cooler than on the plains. Much more rain and snow fall, maintaining a rich forest cover, mostly of evergreen pine, juniper, spruce, and fir but including many seasonal trees, especially oak, cottonwood, aspen, and alder. There are probably more than 100 rainy or snowy days each year at altitudes above 9,000 feet, but even at that altitude 3 days out of 4 are sunny and pleasant. The prevailing color in the mountain country is dark green. At highest altitudes, however, the green cover thins out and patches of drab color and bare rock are common. This is not because there is not enough water to feed plants, but because it is too cold and too windy for them to get a start.

In the northern part of Philmont, the change from plains climate to mountain climate is gradual because the altitude changes gradually. In the southern part, however, the plains pass abruptly into mountains, and the changes in climate and vegetation are equally abrupt.

Plants and animals are certainly part of any landscape, but those of Philmont are not discussed in this book because they are described in "Philmont Nature Story," published in 1960 by the Boy Scouts of America. Drawings of a few of Philmont's animals are, however, scattered through this book.



DEATH OF A LAKE by filling and breaching. (Fig. 21)