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GRASSY COVE, A UVALA IN THE CUMBERLAND PLATEAU, TENNESSEE

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Grassy Cove is located in southeastern Cumberland County on the Cumberland Plateau of Tennessee (Fig. 1). The general usage of the word "cove" to mean a recess or small valley in the side of a mountain or between mountains, is not entirely suitable for Grassy Cove,

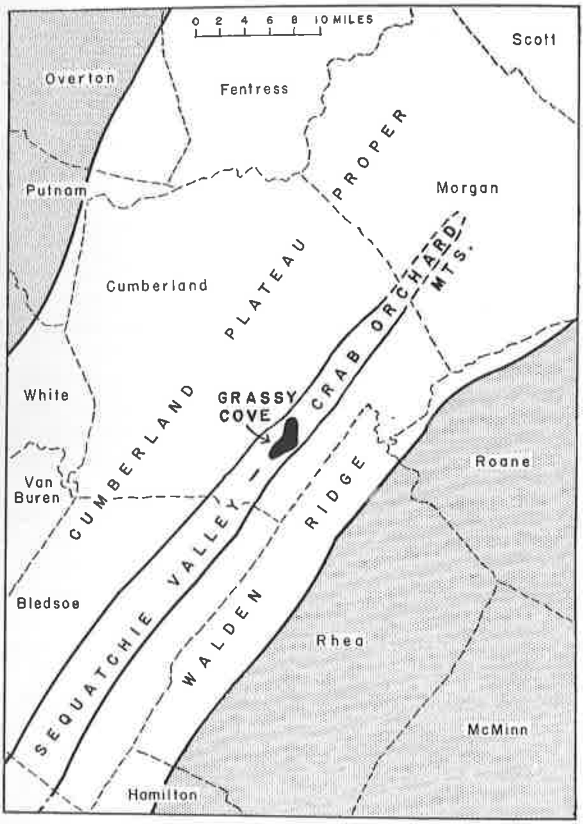

Fig. 1. Map of the east-central part of Tennessee showing counties and physiographic divisions of this region.

because it is completely enclosed by mountains with interior or underground drainage, and should have a descriptive term to differentiate it from a normal valley drained exteriorly by surface streams. Physiographers use "uvala" to designate this type of valley. Uvalas, as described by Cvijic (1893) and Sanders (1921), are formed in limestone regions by the breaking down of rock segments between neighboring dolines. They usually have a diameter of more than one kilometer.

The purpose of this paper is to describe the physiography of Grassy Cove, a uvala, giving its origin, a description of its present landforms, its relation to the underlying rocks, and its relation to other karst in Kentucky and central Tennessee.

Grassy Cove is the largest of six coves in eastern Cumberland County. Its floor contains 3,884 acres. It is crescent shaped with a few indentations about the margins where former surface streams had their entrances and exits. From its center the cove tapers into narrow pointed valleys to the north and southwest (Fig. 2). The north-south arm is 3.4 miles in length and the northeast-southwest 3.9 miles. The greatest width is 1.7 miles bisecting the cove equally along a northwest-southeast axis.

Although Grassy Cove is completely enclosed, there are deep gaps extending from its sides through the surrounding mountains. One of these, standing 260 feet above the floor, cuts through the mountain rim at the northern end of the cove. Another, called Stillhouse Hollow, is a deep v-shaped valley 420 feet deep, the base of which lies 100 feet above the cove floor, and cuts through the mountain to the southeast. These gaps are utilized for transportation, making access to the outside comparatively easy. The greatest relief, 1,415 feet, from the valley floor to the crest of Brady Mountain, occurs along the western side of the cove.

Grassy Cove is situated on the crest of a symmetrical anticline, and in the initial stages of erosion was traversed by one, but probably more, surface streams, as indicated by four prominent wind gaps about the lip of the cove. As streams deepened their valleys into this low anticline, the Pennsylvanian sandstones, which cap most of the Cumberland Plateau, were breached, and the underlying Mississippian limestones were exposed. Subsequently surface erosion was minimized and the process of solution became predominant. By this process many dolines were formed along fissures in the limestones. Finally, there was a coalescing of dolines by collapsing of cavern roofs. The debris can be seen as large blocks of Pennsylvanian sandstone scattered about the margins of the cove floor.

From the floor of the cove to the top of the mountains the slope of the surface is very steep because active solution and sapping are taking place about the cove margins. Through this process of sapping many of the more resistant rock units are caused to stand as prominent ledges, 10 to 80 feet in thickness. These ledges are very conspicuous about the rim of Grassy Cove, and are so steep that

Fig. 2. (Opposite page, above.) Southwestern section of Grassy Cove, looking southwest from the center. The relatively flat floor tapers into a narrow valley at the base of Dorton Knob (center left). Kay Reed (wind) Gap and Brady Mountain in background. Fig. 3. (Middle) Mill Cave, Grassy Cove, is big enough to drain all the streams of this cove except during excessively rainy periods. It is eleven feet high and forty-eight feet wide. The floor and walls are of Ste. Genevieve limestone. Fig. 4. (Bottom) A Grassy Cove sinkhole in Gasper limestone. Water from the Bangor limestone (restricted) plunges over the Hartselle sandstone here. Near the western base of Bear Den Mountain in the southwestern arm of Grassy Cove.

little soil and vegetation are present upon them. The farmers utilize the more gentle limestone slopes up to the base of the sandstones for pasture, but many of these slopes are even too steep for plowing. Above the limestone-sandstone contact, forest dominates the landscape except where scattered farms have been located on gentler slopes of rock terraces.

The major stream is Grassy Cove Creek. It heads in the southwestern end of the cove and flows in a northeast direction for the first half of its journey and then meanders across a flat floodplain to the north-northwest. It leaves through a cave to the northwest in the northern arm of the cove (Fig. 3). Thus, the early settlers named it Sinking Creek, rather than Grassy Cove Creek, and this original name appears on many of the old legal transcripts. The volume of water in Grassy Cove Creek is small, because the area is honeycombed with underground channels, and most of it is carried through subterranean caverns. During periods of low rainfall the headward valleys are entirely dry. During periods of excessive rain, however, when the caverns cannot carry off the greater volume of water, temporary lakes form on the floodplain of Grassy Cove Creek. In 1929 more than 15% of the cove was inundated by water that fell during one night. It was two weeks before transportation could be resumed and three weeks before the creek had returned to its normal flow. Residents in the cove state that on the average one crop is lost every ten to fifteen years because of these temporary lakes. Smaller temporary lakes, however, form in the lowlands every three or four years without damaging crops.

Rapid downward cutting by Grassy Cove Creek has been temporarily halted because in its lower course it passes over a two-foot sandy layer in the Warsaw formation which results in a local base level. Because of this, Grassy Cove Creek has acquired old age characteristics. The stream has a well developed meander pattern with thick layers of silt deposited over its broad flood plain. This sandy phase of the Warsaw formation corresponds with that described by Dicken (1935) in his paper describing the Kentucky karst region. In this report, he states "that in karst erosion the level of the land is lowered until fissures reach an impermeable bed, or until the proportion of insoluble material greatly increases, and although no definite stratigraphic horizon may be designated as the impermeable bed for the whole area of the Kentucky karst, in most cases it is the shaly and cherty limestones of the Warsaw Formation." Thus, the same rock formation that is responsible for old age characteristics in the Kentucky karst is also very prominent in producing the present surface features of Grassy Cove.

The Warsaw formation underlies more than 50 percent of the floor of Grassy Cove. Since the cove is on the crest of an anticline and since the very resistent Warsaw formation dips beneath exceedingly soluble limestone members on the northwest and southeast, the greatest amount of solution, at the present time, is about the margins of the cove floor. It is here that numerous caves, many depressions, and multitudinous sinkholes are conspicuous in the present landscape

(Fig. 4). It is in the Ste. Genevieve and Gasper limestones that the greater amount of solution is now taking place, just as these same members were responsible for the numerous caverns and collapsing roofs in the past. Thus the center of Grassy Cove is in a more mature stage in the karst cycle of erosion than are its margins. Examples of the great solubility of some members of the Mississippian limestones can also be seen in the overlying Pennsylvanian sandstones on the surrounding mountains. In these sandstones are three large sinks, 80 to 100 feet deep, and 40 to 140 yards in width. They are present 140 feet above the nearest limestone unit, nevertheless, they have been formed by the caving-in of this great thickness of shale and sandstone into large caverns in the underlying limestone.

The highly soluble St. Louis, Ste. Genevieve, and Gasper limestones in Grassy Cove underlie extensive areas in central Tennessee and Kentucky. It is in these units that many of the larger and well known caves have been formed, such as Mammoth and other caves in Kentucky, and Monteagle Wonder Cave, Dunbar Cave, and Nicojack Cave in Tennessee.

In summary, the physiography of Grassy Cove, a uvala or valley sink with interior drainage, was formed by the interaction of tectonic processes, stream erosion, and ground water solution. Folding of sedimentary rocks and slow uplift caused the surface streams to cut rapidly through the indurated sandstones exposing the soluble limestones. At this stage of erosion the process of solution became dominant and small sinks soon dotted the surface. These sinks were enlarged by coalescing and collapsing of cavern roofs. These processes continued until an impermeable layer halted the karst cycle in the center of the cove, though they still remain active about its margins. An extensive flat surface is dominant for several hundred feet on either side of Grassy Cove Creek, while rolling hills or hums characterize the rest of the cove floor. The soluble limestone formations that have been so actively sculptured by water in Grassy Cove are also present throughout central Tennessee and Kentucky and have given rise to many large caves and caverns in these areas.

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