THE CRYSTALLINE MONADNOCKS
OF NORTH-CENTRAL WISCONSIN

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Abstract

Located within ten miles of Wausau, Wisconsin are three crystalline quartzite monadnocks—Rib Mountain, Mosinee Hill and Hardwood Hill. This paper is a geographical analysis of these hills stressing their physical and economic features. A review of existing literature preceded map study, air photo examination, personal interviews and field work of these unique landforms.

Composed of resistant Rib Mountain quartzite, the monadnocks exhibit higher elevations, greater relief and steeper slopes than the surrounding landscape. Metamorphosed from ancient sandstones, the quartzite was later recrystallized by igneous intrusions and exhibits great purity. Glaciation of the area apparently occurred in Pre-Wisconsinan time and deposited a shallow drift. Surveyor’s notes indicate the original vegetation was a dense hemlock/northern hardwood forest. However, a fire destroyed most of the cover in 1910 and the resultant growth was largely aspen, birch and shrubs. Shallow, moderately-steep, stony silt loam soils (Typic Glossboralf) dominate the hills.

Use of the monadnocks for agriculture has been generally precluded by the steep slopes and stony soils. The lumbering “boom” of the late 1800’s largely avoided the hills. Occasional forestry operations by private owners have been carried on in recent years. Mining of quartzite commenced in 1893 and several companies have been involved over the years.

It is in the fields of recreation and communications that the monadnocks have had the greatest economic impact. Rib Mountain State Park dates from 1927 and served 189,000 visitors in 1979. The Rib Mountain Ski Area with four major slopes entertained 97,000 skiers in a recent year. Serving as a hub for a complex communication network, the “mountain” supports a number of transmitters and microwave facilities for television, radio and telephone.

INTRODUCTION

As one approaches Wausau, Wisconsin, from any point of the compass, even the most casual observer soon becomes aware of three brooding, heavily-forested, steeply sloping prominences which dominate the landscape of the area. Projecting above the flat-topped upland of the Precambrian peneplain, they are the sharp, ridge-like Rib Mountain, the twin-peaked Mosinee Hill and the smaller, conical Hardwood Hill (Fig. 1). These unique landforms consist of the very coarse Rib Mountain quartzite, perhaps the most resistant rock in nature, and for this reason they maintained their presence during the general degradation of the surrounding area in Precambrian time and remain as remnant hills, or monadnocks, today. The hills are in marked contrast to the relatively level tops of the upland forming the peneplain. They are the remnants of a land surface older than the present peneplain and are typical monadnocks like their namesake, Mount Monadnock in New Hampshire, which bears a similar relationship to
the peneplain of erosion in southern New England. It will be the major purpose of this paper to provide a geographical analysis of the hills which emphasizes their physical and economic characteristics. In addition, a brief review of the geology of the area is included.

**Physical Environment**

**Landform Geography**

Largest of the monadnocks is Rib Mountain which is located in central Marathon County approximately four miles southwest of downtown Wausau (Fig. 2). Formerly called Rib Hill, then Rib "Mountain," this prominence is now called Rib Mountain. Less than a mile from the Wisconsin River (i.e., Lake Wausau), the "Mountain" extends four miles east-west and one and one-half (1½) miles at its maximum width north-south. Slightly arclike in form, which has been likened to a human "rib," its total area is 3.63 square miles. The fame accorded Rib Mountain, however, tends to be based rather on its vertical dimensions—elevation and local relief. For many years it was recognized as the highest point of elevation in the State of Wisconsin at 1,940 feet above sea level. However, a number of years ago U.S. Geological Survey investigators identified two hills northwest of this area (Tim's Hill and Pearson Hill in Price County) which have slightly higher elevations. Rib Mountain still enjoys the distinction of possessing the greatest local relief in the state as it rises 780 feet above Lake Wausau and about 650 feet
Fig. 2. Rib Mountain, from the northeast.

Fig. 3. Mosinee Hill, from the tower on Rib Mountain to the northwest.
above the average level of the crystalline penemplain. This landform feature also includes some of the steeper slopes to be found in northern Wisconsin. Areas near the summit on both the north and south flanks are covered by a talus of quartzite blocks and exhibit slopes of 20 to 30% with the north slope being steeper. A majority of the “Mountain’s” total area displays 12 to 20% slopes while near the base 6 to 12% is more common.

Located one and one-half (1½) miles south-southeast from the eastern end of Rib Mountain and only several hundred yards from the west bank of the Wisconsin River is the second of the monadnocks, Mosinee Hill (Fig. 3). Two summits, located about one mile apart, are seen on the hill which led them to be identified in earlier times as Upper and Lower Mosinee Hills. They are connected by a continuous stretch of quartzite although separated from Rib Mountain by a lower area of quartz syenite bedrock. The northern summit is the larger of the two and reaches an elevation of 1,610 feet above sea level and rises 465 feet above the alluvial plain of the Wisconsin River nearby, while the southern summit has an elevation of 1,472 feet and a relief of only 325 feet. Both of these hills are more gently-sloping on their western flanks (i.e., 2 to 12%), while their eastern sides adjacent to the river possess steeper slopes (i.e., 12 to 20%). Like Rib Mountain, Mosinee Hill’s upper levels are covered with a talus deposit of quartzite blocks, but its total area is considerably smaller occupying 1.18 square miles. Aligned north-south its maximum length is one and three-quarters (1¾) miles and varies from ¾ to one mile in width.

Smallest of the three monadnocks is Hardwood Hill which is located three and one-half (3½) miles in a west-southwesterly direction from the summit of Rib Mountain (Fig. 4). While the two hills previously described are largely in the Town of Rib

Fig. 4. Hardwood Hill, from the east.
Mountain, Hardwood Hill is in the Town of Marathon. Dome-like in form and covering only one-half (½) square mile, the top of the hill has an elevation of 1,610 feet which is 300 feet above the peneplain surface and about 400 feet from the valley floors within a mile or two of the summit. Slopes vary from 12 to 20% near the summit to 6 to 12% on the flanks of the hill. Quartzite blocks are frequently seen near the summit.

Quartzite bedrock with its superior resistance to erosion is certainly responsible for the higher elevations and considerable relief of the hills. The three monadnocks give to the Wausau area Wisconsin a rather unique topography that may be better described as "plains with high hills" instead of as a rolling plain which is more characteristic of most of northern Wisconsin.

Geology Review

The geologic formation responsible for the three monadnocks is Rib Mountain quartzite, an extremely resistant Early Proterozoic (Middle Precambrian) metamorphic rock. Metamorphosed from ancient sandstones and recrystallized more recently, the quartzite is remarkably pure (99.07% SiO₂), white to pale pink in color, vitreous and firmly cemented (Weidman 1907). It varies from medium-grained to coarse-grained with the latter predominating. Quartz crystals range from 3 to 8 millimeters in size. Nevertheless, though being extremely resistant to weathering, the quartzite is somewhat brittle and because of this is often seen as talus on the steeper slopes. Jointing in the quartzite is common but no persistent pattern of jointing is noted. The monadnocks are composed of masses of nearly vertical south-dipping quartzite with an estimated thickness of from 1,000 to 4,000 feet (Weidman 1907). Age of the formation is placed from 1.45–1.50 billion to 1.64–1.67 billion years, probably nearer the latter (LaBerge and Meyers 1972). The large quartzite block at Rib Mountain, and several others nearby, were once part of the roof rock above a syenite intrusion (i.e., Wausau quartz syenite—1.45 to 1.50 billion years old) (Paul and Paul 1980). When erosion breached the roof rock, the underlying intrusive was removed much more rapidly than the resistant quartzite. In time, isolated masses of quartzite stood high above the general erosional surface. It has also been hypothesized that the three monadnocks may be connected at sub-surface levels but no substantive evidence has yet been presented.

Samuel Weidman, author of “Geology of North-Central Wisconsin” (1907), the definitive work on this region, was convinced that this locality was part of the Driftless Area and so mapped it. The absence of quartzite boulder trains marginal to the three monadnocks furnished, he thought, the strongest kind of evidence of the non-glaciated character of the vicinity. Later research by Thwaites (1943) and Hole (1943) suggested that the extension of the Driftless Area along the Wisconsin River valley from Stevens Point to Merrill was glaciated in early Wisconsinan time, possibly Altonian, but as a result of severe erosion by the Wisconsin River and its tributaries most of the drift had been removed. More recent investigations indicate that a pre-Wisconsinan glacial advance moved eastward across this area (Mickelson, Nelson and Stewart 1974). Wausau Drift is the name applied to the thin, discontinuous till deposited by this ice sheet that rests directly on deeply weathered, Precambrian rocks (LaBerge and Meyers 1972).

Vegetation

Federal land surveyors’ notes reported that the natural vegetation of Rib Mountain in 1840 was a hemlock/northern hardwood forest. Presumably, Mosinee and Hardwood Hills supported a similar forest community. Included among the hardwoods were yellow birch, sugar maple, red maple, white ash,
basswood and white birch. Due to their steep and rocky slopes, the monadnocks were largely bypassed by the loggers of the late 1800's, and the forest remained essentially in its native state until 1910. In late July of that year, however, following a severe drought period, a disastrous crown fire destroyed nearly all of the canopy trees on the “Mountain” (Schaetzl 1980). Mosinee and Hardwood Hills were not affected by this conflagration.

Vegetation growth after the fire was dominantly aspen, with considerable white birch and various shrub species. The vegetation remained in this state for nearly twenty years. Upland hardwoods fringed the base of the hill and continued to gain in importance. In 1927, Rib Mountain State Park was established, and the natural succession of vegetation has been encouraged within its boundaries.

A map of forest types prepared for the park in 1971 revealed the continued advance of northern hardwoods up the slopes of the hill. Yet, many areas were still dominated by white birch and aspen. A map compiled by Schaeztl (1980) confirmed the nearly complete dominance of northern hardwood communities on the more gentle slopes while white birch/mountain maple and aspen/white birch/yellow birch communities were predominant on the steeper north and south slopes, respectively. Well over three-quarters of the total area of the monadnocks still supports a forest cover today.

Soils

Soil mapping of Marathon County is currently in progress, and coverage of the three monadnocks is complete. In the area is a group of soils that have developed in part from weathered bedrock or shallow till. A silt covering about two feet thick often overlies these parent materials and probably originated as a local, non-calcareous loess. As a result, moderately-deep to deep, moderately-steep to steep, stony, Gray-Brown Podzolic (mostly Typic Glossoboralf) soils cover the hills. Ribhill, Fenwood, Rietbrock and Sherry are the principal soil series. A summary of the major soil types of the monadnocks including land use capability ratings and current uses appears in Table 1.

**ECONOMIC GEOGRAPHY**

**Agriculture and Forestry**

Utilization of the monadnocks for agriculture has largely been precluded by the steep slopes, stony soils and dense forest vegetation. Only along the base of the hills have the farmers cropped and pastured the land. They cultivate up to the level where the soils become too shallow or stony. A number of stump pastures are present around the base of Rib Mountain and while some have been cleared for cropland most of the acre-

<table>
<thead>
<tr>
<th><strong>Soil Type</strong></th>
<th><strong>Topographic Position</strong></th>
<th><strong>Capability Rating</strong></th>
<th><strong>Current Use</strong></th>
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<tr>
<td>Ribhill stony silt loam</td>
<td>Summit and steep talus slopes</td>
<td>6,7</td>
<td>Woodland</td>
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<tr>
<td>Fenwood stony silt loam</td>
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<tr>
<td>Sherry stony silt loam</td>
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<td>Cropland,</td>
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<tr>
<td>Mosinee loam*</td>
<td>“Sag” area, Mosinee Hill</td>
<td>3, 4</td>
<td>Cropland</td>
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</table>

* Limited acreage
age remains in permanent pasture. Many farmers own land farther up the slopes but since they cannot utilize it for crops or pasture they have wisely left it in forest. At the present time there are four farmsteads on Rib Mountain (all near the western end), four on Mosinee Hill (located on the gentler western slopes and "sag" area) and none on Hardwood Hill.

Following the ruinous forest fire of 1910, loggers moved in and by the latter part of 1911 had removed all of the salvageable timber from Rib Mountain (Schaetzl 1980). An inventive operator devised a wooden chute that made it possible to slide large logs down the steeper slopes allowing for more rapid removal. Occasional forest harvesting operations have been carried on by private owners in recent years. Minnesota Mining and Manufacturing Company (3M) has cut timber selectively on its two properties on Rib Mountain, and the Tigerton Lumber Company owns 144 acres of forest land on the western end of the "Mountain." A private owner has engaged in selective cutting of timber on Hardwood Hill recently (Brechler 1981, personal communication). A fire tower was constructed on Hardwood Hill to serve central Marathon County but is now abandoned.

**Mining**

Mining (or quarrying) of quartzite on Rib Mountain and Mosinee Hill began near the end of the last century, and several companies have subsequently been engaged in

![Fig. 5. Quartzite quarry on the northwestern slope of Rib Mountain.](image-url)
this activity until quite recently. The Wausau Sandpaper Company commenced production in 1893 using quartzite blocks hauled from Rib Mountain to their factory in Wausau (Marchetti 1913). Later they opened a small quarry on the northeastern section of the hill. By 1910 the company was producing 9,000 sheets of sandpaper a day based on the excellent quality of the ground quartzite. In 1901 the Wausau Quartz Company started production of crushed quartz at their ball mill in Wausau (Marchetti 1913). All grades from finest powder up to ¼ inch diameter were ground from quartzite obtained from their two properties on Rib Mountain. The various abrasive purposes for which the quartz was utilized included the manufacture of flint sandpaper, sand blasts, sand belts, pumice stone, marble cutting and match sand. Additional uses for the crushed quartz were for filters, bird grit, wood fillers and stone facing.

Minnesota Mining and Manufacturing Company (3M) purchased 281 acres on the north slope of Rib Mountain in 1929 in order to establish a quartzite quarry (part of the acreage had been owned by the Wausau Quartz Company) (Fig. 5). Operation of the quarry was continuous until 1976 and in that period about one million tons of quartzite were removed to be ground into sandpaper grit. Company officials indicate that production may resume at some future date if the need arises. Duffek Sand and Gravel Company of Antigo operated a quarry on the south end of the northern summit of Mosinee Hill for a short time to procure road aggregate. It was closed after a petition of nuisance was circulated by nearby land owners.

Five exploratory shafts and drifts were opened on Rib Mountain in attempts to strike gold ore of commercial richness; the first as early as 1897 (Berger 1979). One of the abandoned shafts is located just north of the State Park road. Unfortunately, none of the ventures “panned” out although one of the mines was reported to have been salted with California gold dust in an attempt to lure unwary investors.

Recreation

The heart of recreational development is Rib Mountain State Park which occupies 860 acres on the summit and north and south slopes. Inception of the park dates from 1923 when forty acres were given to the state by the heirs of the Jacob Gensman estate for that purpose. Four years later in 1927, it officially became a state park. Completion of a winding three-mile road up the east side of Rib Mountain in 1931 gave the public access. Six subsequent gifts of land by individuals, a club, corporations and Marathon County plus Department of Natural Resources land purchases totalling $164,000 expanded the park to its present size. The park includes a 31-unit campground, 3.1-acre picnic area, 3,200-foot nature trail with signs, 1.25-mile snowmobile trail, 2.5-mile hiking trail and a forty-foot tower with three observation platforms that affords a 30-mile view. Table 2 summarizes attendance at Rib Mountain State Park in recent years (Wisconsin Blue Book 1981).

A newly-proposed master plan for Rib Mountain State Park calls for a $1,000,000 expansion and improvement over the next two decades. Total area of the park would be increased from the present 860 acres to 1,219 acres at an estimated cost of $500,000. However, private development is encroaching on some boundary areas of the park and causing land values to soar. Improvements called for include expanded day use, new water system, expanded picnic area, new

<table>
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<tr>
<th>Year</th>
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<td>1982</td>
<td>221,333</td>
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<tr>
<td>1983</td>
<td>194,995</td>
</tr>
</tbody>
</table>

* Includes skiers at Rib Mountain Ski Area
parking lot, open shelter, playground equipment, observation deck adapted to wheelchairs, expanded trail system, new office/visitor entrance station, road repairs and rebuilt park entrance. Total cost of the above would be $500,000 and take at least ten years to complete.

Also located within the state park on a 160-acre tract on the north slope is the Rib Mountain Ski Area (Fig. 6). Cleared of timber and rocks by the Civilian Conservation Corps in the 1930’s, it features a 550-foot drop between the elevations of 1,250 feet and 1,800 feet. For many years the ski area was operated by the Wisconsin Conservation Department (now the Department of Natural Resources) who later turned the operation over to a group of local businessmen, who in turn, worked directly under the supervision of the Marathon Civic Corpora-
tion. The latter group, a division of the Wausau Area Chamber of Commerce, holds the ski concession and in 1964 contracted with a private concessionaire, the Rib Mountain Ski Corporation, to run the ski area. Between 1965 and 1976, a total of $780,000 in improvements were instituted at the ski area by the concessionaire.

Skiing at Rib Mountain Ski Area offers fifteen slopes which vary from gradual to steep, to suit each skier from beginner to expert. Included are four major slopes that are groomed by an extensive snow-making system which is employed when necessary to compensate for nature’s deficiencies. Ownership of facilities at the ski area is a cooperative venture. The state owns the land, the main chalet and eight other buildings, four rope tows and a T-bar while the concessionaire owns two chairlifts (one is

![Fig. 6. Rib Mountain Ski Area, from the north.](image)
3,300 feet long), a T-bar and several buildings. Services available at the area include a ski shop, rental shop, repair shop, ticket sales shop, sun porch, cocktail lounge and cafeteria. Drawing heavily on southern Wisconsin and Chicago areas for its clientele, the ski area has suffered at times from the lack of natural snow. Following the record 1977–78 season, the attendance dropped dramatically in the 1979–80, 1980–81 and 1982–83 seasons when the winters were abnormally mild with meager snowfalls. Table 3 indicates the numbers of skiers using the ski area in recent seasons (Oliva 1983, personal communication).

Communications

While Mosinee Hill supports a single corporate radio tower and Hardwood Hill an abandoned fire tower, Rib Mountain is the hub of a complex communications network. As one of the state’s highest points of elevation plus having its greatest local relief, it lends itself well to this type of economic activity. A 746-foot television tower, looking like a gigantic toothpick stuck into the “Mountain,” dominates the electronic apparatus atop the hill. The tower is jointly owned by WSAW-TV (Channel 7-CBS) and WAOW-TV (Channel 9-ABC), and its highest point serves as the antenna for the two stations. Somewhat lower on the tower is the antenna for WHRM-TV (Channel 20-PBS) which went on the air in October of 1975. Farther down are the antennas for WIFC-FM radio and WHRM-FM radio. Below that are various governmental communications antennas such as NOAA’s 24-hour radio and the Wisconsin State Patrol network plus a radio repeater that receives signals from amateur radio operators and rebroadcasts them to a 60 to 70 mile radius. Closer to the bottom of the tower is a series of cone-shaped antennas to receive microwave signals for all incoming television network programming. At the base of the tower are the transmitter facilities for the three television stations which although they appear to be in one building are separate. The transmitter produces about 35,000 watts of power which concentrates into 316,000 watts at the tip of the tower and allows the stations to serve some seventeen counties in northern Wisconsin.

Rib Mountain is the key to communications for Marathon County agencies through a smaller tower that controls radio traffic of the sheriff’s department, highway department, park department, office of emergency government and Wausau fire department. Also on top of the “Mountain” are microwave facilities of General Telephone and Electronics and American Telephone and Telegraph that handle long-distance telephone calls for the area. From two rather small buildings at the base of two bulky microwave towers, the GT&E facility can handle about 7,000 conversations and the AT&T equipment upwards of 20,000 conversations at a given moment.

CONCLUSIONS

Having traversed Rib Mountain, Mosinee Hill and Hardwood Hill on foot, the author can attest to their unique character and scenic beauty. Largely due to stony soils and steep slopes, agriculture and forestry have only marginally touched the monadnocks. It is in the fields of recreation, communications and mining that the hills have had the greatest economic impact in the past and, most likely, in the future.

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REFERENCES CITED


