

THE GEOLOGIC MAPS OF RYLAND T. BROWN, 1865-76

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ABSTRACT: In 1854 Ryland T. Brown was appointed "geological agent" by Indiana Governor J. A. Wright, president of the Indiana Board of Agriculture, to conduct a geological survey of the state. Although his tenure was brief, he later compiled a geologic map of Indiana that was printed in 1865 and that appeared also in atlas volumes dated 1870, 1871, and 1876. Because David Dale Owen's 1837-38 and 1859 geologic maps have long been lost, Brown's are among the earliest statewide geologic maps of Indiana.

In comparing Brown's map with Nelson Saylor's 1865 map and with maps reconstructed from Owen's texts, it is apparent that although the maps vary in the way the geologic units are classified, described, and drawn, the mapping units and their boundaries are broadly similar. The authors all endeavored to reconcile their descriptions of Indiana rocks with classic units described in England and in New York, and indeed their subdivisions are recognizable today.

Other publications by Brown indicate that he carried on extensive fieldwork. He classified Indiana soils, described new locations of industrial minerals, described the extent and composition of the drift in Indiana, and was among the first to ascribe those deposits to glaciation. He did not, however, map the surficial deposits.

INTRODUCTION

The second State Geologist of Indiana, Ryland T. Brown (1807-90), is an enigmatic and relatively unknown figure in the history of Indiana geology, despite mention in three papers reviewing the contributions of Indiana scientists (Bland, 1906; Blatchley, 1917; Inlow, 1960) and biographical treatment in two more (Anonymous, 1888; Melhorn and Kenaga, in preparation). Brown's tenure was brief and of uncertain date, he called himself a "geological agent," and he was appointed by the Board of Agriculture rather than by the legislature. His listings in the bibliography of Indiana geology (Nevers and Walker, 1962) are few, and Indiana geologists have wondered just how much geologic work R. T. Brown actually accomplished.

We have determined that Brown carried out a considerable body of geologic work before, during, and after his tenure as Geological Agent. His career in geology can be said to have begun at Wabash College, where he was awarded an honorary A.M. degree in 1850, although there is some evidence that he engaged in geologic fieldwork for a few years before that date. We present here a list of published papers that we have found, without, however, implying that the list is complete. Much of his work was reported in obscure sources, which may explain its absence from bibliographies of geology. Most important, we have learned that he is the author of one of the first, if not the first, of the published geologic maps of Indiana. This map was not mentioned by Patton and Gray (1973) in their review of statewide geologic maps of Indiana, and it is this map that we report on here.

Starting with the first geological surveys of the state by David Dale Owen in 1837 and 1838, the need for a geologic map and comprehensive information pertaining to the geology of the state became a continuing concern. A partial response to this need

had been met by geographic maps and gazetteers accompanied by information pertaining to commercial interests in Indiana. These were prepared as guides for immigrants to the state and served the “combined function of sales brochure and information handbook” (Byrd and Cagle, 1966, p. 14). An example, one of many dating from throughout the first half of the 19th century, is the map published by J. H. Colton (1838), which was accompanied by a text on the geology of Indiana reprinted from Owen’s conclusions from his survey of 1837.

In 1851 Governor J. A. Wright proposed preparation of a “map which shall tell us the depth of our coal seams, the best location of our iron furnaces, the extent and value of our marble and stone quarries, the worth of our exhaustless quantities of timber, and the true character of our soils” (Guffin, 1875, p. 214). Several years later, in support of this same goal, Brown (1856, p. 253) proposed to “give to the world a map of each county on a scale of not less than half an inch to the mile, bound in a convenient atlas form with the accompanying report exhibiting geology, topography, soil, timber, water, etc. The sale of the work would shortly reimburse the funds expended in the work.”

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Brown ultimately did prepare such a map but not under the aegis of the State of Indiana. His map appears in three basic formats. The earliest, copyrighted in 1864 and published in 1865, is a single-sheet wall map entitled “New Civil and Congressional Township Map of the State of Indiana” (version 1.1; see list of geologic maps appended). The geologic information is credited to Brown, who was at that time Professor of Natural Science at Northwestern Christian University in Indianapolis.

On this map the geologic boundaries are presented by dashed black lines that are emphasized by dark blue lines hand traced in watercolor. The descriptions of the five geologic divisions depicted follow the Ohio River, which suggests that Brown examined the banks of the river as Owen had done in the spring and summer of 1837. The oldest rocks, which are in southeastern Indiana, are labeled as “Dark Blue Limestone abounding in marine Fossils—heavy beds of blue Clay between the Strata,” also labeled the Trenton Limestone of Hall, a New York geologist, and the Lower Silurian of English geologists. Just west of Madison is the “Gray Limestone in thick Strata with but little Clay between them,” also identified as the Niagara Limestone of Hall, the Upper Silurian of English geologists, and the Cliff Rock of Locke, an Ohio geologist. At Jeffersonville is the base of the “Soft, fine grained clay Sand Stone Varying in colour—Gray, yellow, red, or lead colour,” also known as the Chemung Sandstone of Hall and the Subcarboniferous Sandstone of Owen. Near what today is known as Evans Landing is “Coarse grained gray Limestone in thick Strata,” also labeled as the Subcarboniferous Limestone of Owen and the Mountain Limestone of English geologists. Finally, near Leavenworth, the youngest rocks are described as “Coarse grained Sandstone, more or less tinged with Iron interchanging with beds of Bituminous Coal, imperfect Limestone, Fire Clay, and Shales,” also known as the Coal Measures.

A second version of the map (2.1, 2.2a, 2.2b) was published in 1870 and 1871 in a geographic atlas that shows clusters of Indiana counties at a scale of approximately 1/4 inch equals 1 mile. A small-scale geologic map of the entire state appears on a corner of the pages that show the southeastern counties, no doubt because there is room to include it there. In addition, traces of the geologic boundaries are shown across the

county maps throughout the atlas, which makes this the first large-scale geologic map of the state, albeit without color and in several sheets. A text description (Anonymous, 1870, 1871), which is credited to "Owens' report" and which is a collage of all the earlier Owen reports, appears on the atlas pages that follow the maps. Preparator of this text is not known.

In 1876 a third and final version (3.1) of the map appeared in another atlas by a different publisher. In this atlas the counties are shown on a larger scale and are one to a page or a two-page spread, and the geologic boundaries are not shown. The same geologic map as before is shown on a separate page, and a text authored by Brown follows the maps. The colors on this map differ from those of previous versions, but all these maps were hand colored and each copy is therefore somewhat individual. In the three copies we have seen of this version, the colors on the explanation are in reverse order from those on the map.

The geologic boundaries, classification, and descriptions are substantially the same on all the maps, but because the text description accompanying the third version (Brown, 1876) does not tally precisely, it may have been the product of Brown's more mature years. For example, on the maps the limestones and dolomites that are now classified as Silurian and Devonian in age are not separated and are described only as "Gray Limestone," yet in the text Brown correctly recognizes the ages of these rocks and describes them separately.

We consider Brown's 1865 map to be an original work, in contrast to Nelson Saylor's map of the same date, which we regard as a compilation because we are not aware that Saylor conducted any fieldwork and because the Saylor map is one of a series covering several states produced for his Cincinnati publisher. Both Saylor and Brown had available a limited body of published information, mainly from the pens of David Dale Owen and Richard Owen, and both may have seen the manuscript map presented to the Indiana legislature in 1859 by David Dale Owen. Yet Saylor's and Brown's maps differ in many details from each other and from Owen's description of his map. Owen had seven geologic units in his classification scheme, Brown had five, and Saylor had six. Boundaries that should correspond from one map to another are in places mapped (or described) miles apart. And finally, all these authors suggested correlations of the Indiana rocks with those in the better known sections of England and New York, and here too there are differences among the assigned correlations.

Saylor, alone among the three, shows a southern margin to the "Post Tertiary and Modern Diluvium and Alluvium" that covers northernmost Indiana, and he alone shows small areas of Devonian and Subcarboniferous rocks beneath the Diluvium in north-eastern Indiana. From the latter we infer a debt to James Hall (1843), whose map was among the first to delineate the Michigan Basin. We surmise further that both Hall and Byrem Lawrence (1843) to an extent purloined the earlier work of Owen in their mapping, because the introduction to Owen's 1846 map and paper on the geology of what were then called "the Western States" indicated that their publication was an attempt to recover for Owen the credit for discovering "many important points" in the geology of what is now the Midwest. All in all, we find it difficult to say who borrowed what from whom, but we do conclude that, beyond the fact that Owen was the pioneer, Brown too created an original work based at least in part on his own field experience.

PLACEMENT OF BROWN IN THE HISTORY OF INDIANA GEOLOGY

The reestablishment of the State Board of Agriculture under Governor Wright in 1851 brought renewed pressure on the legislature to reinstate a state geological survey

(Melhorn and Kenaga, in preparation). The first notice of work by R. T. Brown concerning Indiana's geology is in 1852, 13 years after D. D. Owen's first and second survey reports were printed. At this time he delivered a lecture to the legislators entitled "The Geology of Indiana as an Element of Wealth to the State" (Brown, 1852). This marks the initiation of an active campaign to have the legislators appropriate funding for a continued geological survey of the state. Whether the 1853 republication of the first (1837) Owen report was instigated by Brown (see appendix by Gray in Owen, 1987), or whether it was an attempt by someone else to forestall Brown's appointment to carry on a geological survey, we do not now know. In any case, the legislature refused to establish a geological survey, and when Brown was appointed "geological agent," apparently in 1854, it was Governor Wright who made the appointment as president of the Board of Agriculture. Brown's interest in legislative establishment of a continuing Indiana geological survey was enduring, however, throughout most of the period between the earlier (1837-38) and later (1859-61) Owen surveys.

In the section on coal in his geological survey of Indiana (1854), Brown mentioned an "able and energetic company," the American Cannel Coal Company, of Cannelton, Indiana. In 1855 Hamilton Smith, a member of the American Cannel Coal Company and a Representative from Perry County, proposed a resolution to the House of Representatives requesting the printing of 1,000 copies of the geological survey by Brown (Journal of the House of Representatives, 1855). This resolution was not adopted, and in 1857 Smith published for the State Board of Agriculture a paper entitled "Coal Mining in Indiana" (Smith, 1857). Later, Smith "did much toward bringing about the enactment of the law creating the survey authorized in 1859" (Blatchley, 1917, p. 114).

The second survey of the state to be authorized by the legislature was preceded by lobbying by Wright and Brown during the years 1855 to 1857. In 1858 Brown made a final appeal to the public before accepting a position as chairman of Natural Science at Northwestern Christian College (Melhorn and Kenaga, in preparation). In 1859 the same year that Owen's first and second reports were reprinted with revisions, David Dale Owen was again appointed State Geologist. He designated his brother Richard as chief assistant.

Following publication of the report by Richard Owen (1862), who completed the survey after his brother's death in 1860, there were further appeals by Governor Oliver P. Morton as well as lobbying and published work by Brown. In his annual messages of 1863, 1865, and again in 1867, Morton stressed the importance of understanding Indiana's mineral resources (Guffin, 1875). In 1868, at the request of acting Governor Conrad Baker, Brown compiled a pamphlet entitled "Indiana and Her Resources" (Brown, 1868b), 10,000 copies of which were distributed throughout Pennsylvania and the eastern states (Guffin, 1875). Still another report by Brown published in the State Agricultural Report for 1867 pertains to the mineral resources of Indiana (Brown, 1868a).

In his annual message of 1869, Governor Conrad Baker requested that a permanent office be established for the State Geologist (Esarey, 1924). During that same year, the Indiana General Assembly approved the legislation and thus provided for a Geological Survey and an Office of the State Geologist. The organization was named the Department of Geology and Natural Science under the State Board of Agriculture with Edward Travers Cox of New Harmony as its head.

RYLAND T. BROWN'S PUBLISHED WORK

Brown published on many subjects, including soils, industrial minerals, and coal resources, in agricultural journals, in newspapers, and in publications sponsored by the

Indiana Board of Agriculture. We summarize below a few of his contributions on specific geologic topics.

Building stone. Brown's most comprehensive geologic report, entitled "Geological Survey of the State of Indiana" (Brown, 1854), presented data on the location of building-stone deposits suitable for commercial development as one indication of Indiana's self-sufficiency. The Whitewater Valley contains a "high polish marble" (limestone). The "Cliff Rock" (Laurel Limestone Member, Silurian System) includes argillaceous strata that were used to construct part of the Wabash and Erie Canal. These later needed to be replaced because they proved not to be durable, but the magnesian variety (Saluda Member, Ordovician System) was successfully used to construct the Louisville (Kentucky) courthouse. The "Chemung Sandstone" (Borden Group, Mississippian System) contains what Brown considered a durable building stone equivalent to the sandstones of the Scioto Valley of Ohio; he cautioned, however, against using the blue or leadcolored variety because it tended to deteriorate, unlike the buff or drab, which hardened on exposure. Brown praised the "White River Stone" or Mountain Limestone of English geologists (present Salem Limestone) for its durability; after 30 years of exposure the foundation of the Bloomington courthouse still "preserves its corners." In 1868 Brown further described locations and information concerning industrial minerals.

In 1870 in an article serialized in the Indianapolis Journal and entitled "The Indiana Coal Field," Brown mentioned a sandstone equivalent to the "Millstone Grit" that demonstrated its durability "by the conditions of long exposed cliffs." The whetstones of French Lick were attributed to this unit as was the coarse sandstone used to build the Cannelton cotton mill in 1849. He further noted that above the "bituminous shale, which forms the roof of the main block coal," there is a nearly white sandstone that is used for the manufacture of grindstones.

Iron ore. Before the competition from abundant high-grade ores from Lake Superior and Missouri, sources of iron were considered vital to the manufacturing interests of Indiana. Specific deposits mentioned by Brown (1854) are near the Falls of Eel River, near Lodi, and near the Narrows of Sugar Creek. He recognized deposits of nodular iron ore associated with the knob sandstone, limonites of the coalfield ("kidney" and "stone" ores "in the shale lying between the mountain limestone and the millstone grit above it," 1868a, p. 515) and bog ore.

Beginning about 1868 the block coals were used in blast furnaces for smelting ores (Brown, 1876) because they were found to be usually free from sulphur and produced pig iron resembling the Tennessee "charcoal metal." An interesting suggestion was made by Brown for developing the iron deposits of northern Indiana where there was no coal and little timber for making charcoal. He noted that in northern Europe peat was used successfully for manufacturing iron and suggested an experiment in the reduction of bog ore with peat.

Coal. Brown stressed repeatedly the importance of bringing together the agricultural and manufacturing interests of the state. He stated that the Illinois coalfield "presents coal beds as extensive as any in the world covered by a soil as fertile as the Delta of the Nile" (1852). His estimates of Indiana coal resources (Brown, 1857) were, however, considered wildly optimistic by some influential members of the legislature, and this probably played a part in their refusal to establish a geological survey or to appoint Brown State Geologist. According to Merrill (1920, p. 74), the legislature refused to

publish Brown's survey report of 1854 "on the ground that it conveyed an erroneous and exaggerated idea as to the value of the coals of the State."

Brown's estimates were, if anything, conservative and ultimately he was vindicated. His report entitled "The Manufacturing Capabilities of the Indiana Coal Field," originally printed by the State Board of Agriculture in 1857, was reprinted in revised form in 1879. The later version contains a footnote by Brown stating that at the time of the first printing he "was regarded as a visionary enthusiast, whose speculations might amuse for an hour, but were deserving of no further attention" (Brown, 1879, p. 184). By 1879 attitudes toward the coal resources of Indiana had changed.

Soils. Like David Dale Owen, Brown also placed an importance on the soils of Indiana. As early as 1852 he noted that there are eight classes of soils. These included those of the drift formation (1856). He served as chief of T. A. Bland's staff of writers on "scientific farming" for the *Indiana Farmer*, previously called the *Northwestern Farmer*, from 1866 to 1871. Bland sold the *Farmer* to a Mr. Kingsbury in 1871, who retained Brown on his staff until Brown's death (Bland, 1906). Richard Owen also published a number of articles in yet another publication entitled the *Indiana Farmer*.

Glacial deposits. Brown's thoughts regarding glacial geology and the origin of the "drift formation" were developed over what seem to be many years of observation during fieldwork and interest in the theories that were being proposed at the time. In several of his papers he reveals an understanding of the character and distribution of the drift that led him to be the first Indiana geologist to ascribe these deposits to glacial origin. His first-hand field experience apparently began before his tenure as Geological Agent. In an annual report prepared by State Geologist John Collett is a letter from Brown (1880) that discussed the origin of the drift and that mentioned fieldwork done "more than thirty years ago," that is, before 1850. Early in his writings (1852) he used the term "Glacial Period," although in the same publication he also used the term "Diluvial Formation," implying torrents of water.

In Brown's (1854) geological survey, he referred to the influence of the "Drift Period" on the topography of the state. He mentioned a broad valley lying east of the Knobs that exhibits a surface which had been "subjected to the denudined [sic] influence of mighty currents of water," causing the "fragile slate" to be carried away and thus "undermining the sandstone above" (Brown, 1854, p. 307). He suggested that this "natural inclined plane" was suitable for a railroad route from the Ohio River to the interior of the state. Today we call this physiographic region the Scottsburg Lowland, and it indeed is a major route for transport by rail and by road.

In a later publication on the soils of Indiana, Brown (1856, p. 247) again suggested water as the transporter of the "drift formation." Citing Cuvier, he stated that this was "not a mere inundation of the earth by a sheet of standing water, but an overwhelming of it by mighty currents." He further added that after spending a large amount of time in the field, he had noticed an absence of either marine or fresh-water remains in the drift, which convinced him of "the falsehood of the hypothesis which supposes that the drift was quietly laid down from floating icebergs at the bottom of an ocean..." (1856, p.249). Instead, he envisioned "mighty currents of water rushing down from the north, bearing along with them the vast ice fields of the polar seas." In this same publication he described three units of the "drift formation." From oldest to youngest these are a leadcolored clay or dark marlite that in places contains fragments of perfectly preserved wood, a deposit of gravel that contains reservoirs of water, and an upper blue

clay that “gradually fades into a yellow clay above on which rests the soil” (1856, p.250). Clearly these are till, outwash, and loess.

Despite his earlier uncertainties, eventually Brown fully accepted the glacial theory for the origin of the drift and attributed the transport of the drift to the “combined agencies of ice and water” (Brown, 1876, p. 199). Further, he noted that the “rush of mighty torrents” derived from melting glaciers.

CONCLUSION

Brown’s geologic work began perhaps 20 years before first publication of his maps and continued for another 20 years. He was a strong and continuing supporter of a state geological survey. In this light it seems strange that neither of the Owens made any mention of his efforts and also that E. T. Cox as State Geologist (1869-79) made no use of his geologic knowledge and talents. We surmise, as do Melhorn and Kenaga (in preparation), that Cox, being a close associate of the Owens, for some reason also preferred to ignore Brown’s work. This prejudice apparently did not carry over to Cox’s successor, John Collett, for whom Brown did author several county geologic reports (Brown, 1882, 1883, 1884a, 1884b, and 1886). These, however, do not reveal the prescience and depth of thought suggested by his earlier work. Much remains to be learned concerning Ryland T. Brown and his career in geology. We hope we have shed some light on the ability and oeuvre of this man.

ACKNOWLEDGMENTS

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LIST OF GEOLOGIC MAPS BY RYLAND T. BROWN

- 1.1 Asher and Adams’ New Civil and Congressional Township Map of the State of Indiana. Compiled and draughted by Frederick Stein from the latest official United States surveys, exhibiting the sections and fractional sections, the boundaries of civil township and counties, canals and railroads, the location of cities, villages and post offices. *Indianapolis: Asher and Adams, 1865*. Lith., Sage Sons and Co., Buffalo.
Colored map, 148x99 cm. The boundaries of the geologic divisions are presented by small dotted lines (heavy dark blue lines can be seen tracing these outlines). Geologic descriptions follow the Ohio River. Differences from later atlas descriptions include: No reference to Subcarboniferous Limestone (Eng. Geol.); refers instead to Subcarboniferous Sandstone, Owen. Also coarse “grained” sandstone instead of coarse “granite” sandstone of later versions. The geologic information is credited to Brown in the following manner: “Geological Survey compiled and arranged by R. T. Brown, Prof. of Nat. Science, N.W. Christian University and late State Geologist”. Scale ca. 1:311,000. Seen at Indiana State Library.
- 2.1 “New Topographical Atlas and Gazetteer of Indiana: comprising a topographical view of the several counties of the state; together with a railroad map of Ohio, Indiana, and Illinois; an alphabetical gazetteer, giving a concise description and the location of cities, villages, postoffices, railroad stations, landings, etc; and a brief history of Indiana.” *Indianapolis: Higgins and Ryan, 1870*

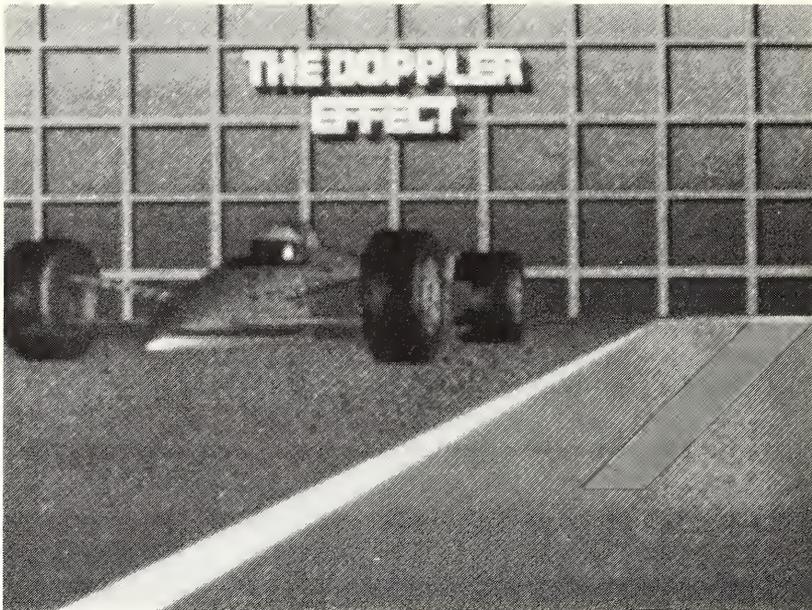
The individual county maps appear to have been derived from the 1865 map. On p. 12 is a colored "Geological Map of Indiana by Prof. R. T. Brown." On p. 40 is the "History and Gazetteer of Indiana, with Topographical Key." Included under this heading on p. 49-52 is "Geological Formation of Indiana." This text is credited to "Owens' report" and is evidently assembled from David Dale Owen's 1837-38-39 reports, his extensively revised 1859 report, and Richard Owen's 1862 report. Text referring to block coal is not Owen's work. In "Explanation to Geological Map" on p. 12, the following differences from the 1865 map are noted: "Subcarboniferous Limestone (Eng. Geol.)" not "Subcarboniferous Sandstone, Owen" (of version 1.1). "Coarse granite Sandstone..." instead of "Coarse grained Sandstone..." (of version 1.1). "Boundaries of the Geological Divisions are also presented by the small dotted lines running through the several Maps of this Work," (not on version 1.1). Scale ca. 1:316,800 for individual county maps. Scale ca. 1:2,300,000 for the geologic map. Seen in the Indiana University Library.

- 2.2a "New Topographical Atlas and Gazetteer of Indiana: comprising a topographical view of the several counties of the state, together with a railroad map of Ohio, Indiana, and Illinois; an alphabetical gazetteer, giving a concise description and location of cities, villages, post offices, railroad stations, landings, etc., and a brief history of Indiana." *New York: Asher, Adams, and Higgins, 1870 and 1871* No. 335 Broadway. Electrotyped at the Franklin Type Foundry, Cincinnati, Ohio. I.W. Field, Map Printing, Coloring and Mounting Establishment. 410 Walnut St., Philadelphia
Contents same as above. Seen in the Indiana University Library.
- 2.2b "New Topographical Atlas and Gazetteer of Indiana: comprising a topographical view of the several counties of the state, together with a railroad map of Ohio, Indiana, and Illinois; an alphabetical gazetteer, giving a concise description and the location of cities, villages, post offices, railroad stations, landings, etc., and a brief history of Indiana". *New York: Geo. H. Adams and Co., 1871*. 335 Broadway. Indianapolis, In: Corner Illinois Street and Kentucky Ave. Electrotyped at the Franklin Type Foundry, Cincinnati, Ohio.
Contents same as above. Bound in original red and black cloth. Seen in Lilly Library, Indiana University.
- 3.1 Illustrated historical atlas of the State of Indiana. Illinois: Baskin, Forster and Co., 1876. Lakeside Building, Chicago.
On p. 7 is a "Geologic Map of Indiana" (no credits are given). This colored map is on a smaller scale than the 1870-71 geologic map noted above, but the boundaries and the explanations are the same. The county maps are entirely different from the ones contained in the atlas noted above. Noted on three copies that the colors for the oldest and youngest strata are reversed on the map. On p. 199 the following text is noted: "Geology, Topography, Etc. by Dr. R.T. Brown" (economic geology, p. 199-200; coal, p. 200; iron ore, p. 200; other minerals, p. 200; topography, p. 200; soils, p. 200-201). Also contains on p. 214 the history of the State Board of Agriculture and the geological surveys of Indiana. This is credited to Henry Guffin and was reprinted from an article in the Twenty-fourth Annual Report of the State Board of Agriculture. Three copies seen at Geology and Main Library, Indiana University.

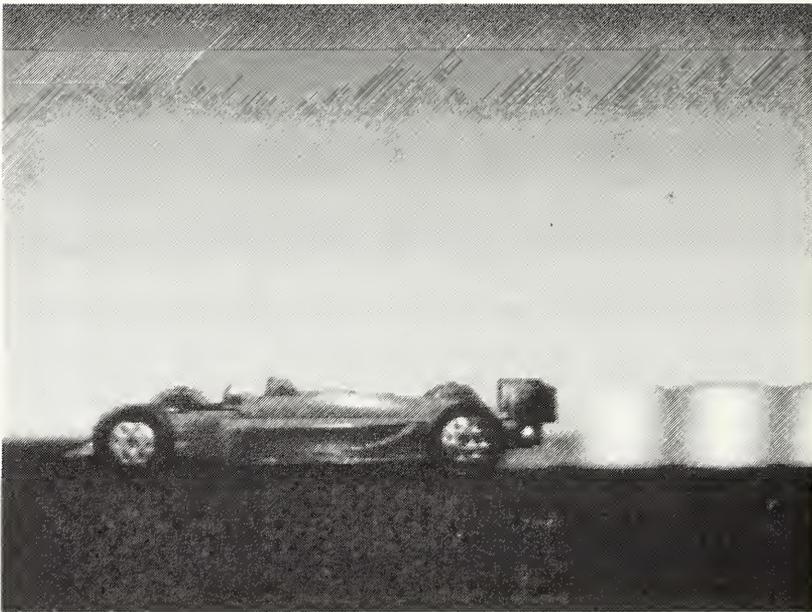
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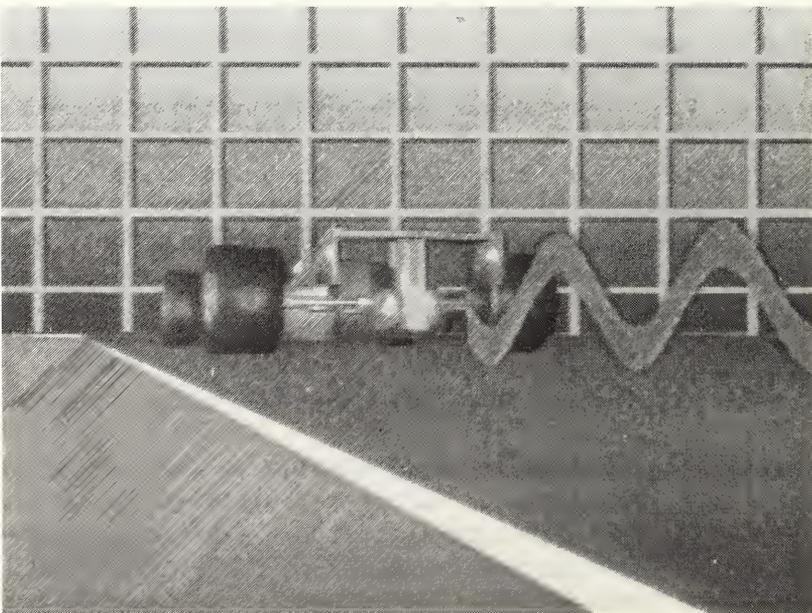
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