ORIGIN OF CIRCULAR RING FEATURES IN THE WETLANDS OF ONTARIO, W. H. Pinson, Jr., Dept. of Earth & Planetary Sciences, M.I.T., Cambridge, Massachusetts 02139, U.S.A.

In 1977 Dr. Raymond Murphy of the Agricultural Engineering Dept. of the MacDonald Campus of McGill Univ. brought to my attention some curious circular features on aerial photographs taken NW of Hearst, Ont. These rings had been previously noted by Usig (1) and Mollard (2), and three hypotheses were extant: man-made; former thermokarst lakes; and fairy ring (fungus) phenomena. Mollard favored the second, and our field studies do too. Dr. Murphy suggested a fourth: buried meteorite impact craters. Then, between us, we thought up a half dozen more, including buried sink holes and volcanic pipes. We overflew the area and concluded that the rings are botanical manifestations and needed field work. In 1978 the field work was done. Our party consisted of the P.I., his son Harlow Pinson, and botanist-forester Malcolm Kirk of Ravenna, Ont. We studied Murphy's discovery area near 50° 30'N, 85°00'W. We studied one ring intensely and traversed about 7 more. See Canadian aerial photographs A23552-13 & -14. There are magnetic anomalies in the area, but we could discover no correlation with the rings, thereby ruling out the volcanic pipe hypothesis. (A buried kimberlite pipe in Kansas has a similar appearance.)

Field work revealed no relief features defining the rings. They occur in conifer swamps (3) and are obliterated where treed bogs have encroached. No particular assemblage of plants defines their peripheries. On any ring periphery some grass, sedge, leatherleaf fen areas occur; some parts are treed bogs; commonly the periphery is marked by stunted trees; and some are defined by large wind-thrown trees and new growth. Permafrost occurs sporadically in our field area and as far south as Cochrane, Ontario.

Botanists and foresters in the wetlands know that where the peat is deep, stunted trees grow. Adjacently, where peat is thin over the clay, the trees grow large. With a soil auger we made the discovery that the rings' periphery (uniformly about 30m wide, regardless of ring size) are defined by a deep moat of peat. Inside and outside their periphery the peat covering over the clay is relatively thin. There the trees are well-rooted and better nurtured. The deep circular peat moat is usually relatively poor in plant nutrients, accounting for the stunted growth. Sometimes it is wetter. A noteworthy exception was discovered on a ring on a gently sloping surface where water ran downhill to a small tributary of the Ash River and crossed the peat moat. There, large trees (10" diam.) grew in the deep peat, because the flowing water brought them nutrients. But these trees, though as large as those centerward and outward, were poorly rooted. That ring periphery was defined by wind-thrown trees, directionally aligned in groups. Inevitably, at intervals of a century or more, storm winds blew these big trees down.

Several other clusters of rings are known, roughly parallel to the SW shore of James Bay, but 100km or more from it, and extending from the Quebec border and Cochrane to about 130km NW of Hearst. We discovered that the bedrock underlying the rings can be either sedimentary (Paleozoic, as at Ash River), or igneous or metamorphic (as south of Kapuskasing). Sometimes glacial till

underlies the clay. Once our auger struck a rock and we dug up a granite boulder from atop the clay.

What could make a circular, deep moat of peat? I can think only of dense vegetation bordering a nearly circular lake, persisting in its growth as the shallow lake filled with river-borne silt. The lake was on a treeless, flat plain recently emerged, when the overlying burden of continental glacial ice retreated a few thousand years ago. Spagnum moss, a great peat former (4), covered the whole area. Then the spruce forest encroached. The relic lakes became raised bog areas suitable for black spruce growth. But truly circular lakes of whatever origin are rare indeed. For example, thermokarst and thaw lakes are ovoid but rarely ever circular. Likewise for sinkholes. Meteorite impact craters are circular, but this hypothesis was early ruled out because most rings are uniform in size and about 0.9km across; the peripheries, regardless of ring size, are of uniform width, as a plant border to a lake, large or small, might be. Some rings overlap in patterns impossible to interpret as resulting from successive explosive impacts; and the geographical distribution is wrong. Bird (5) in Physiography of Arctic Canada, Fig. 58, shows "Thaw lakes and former lakes on the Great Plains of the Koukdjuak, Baffin Island," which could possibly be an analog for the Ontario rings. But the Baffin Island lakes are not so remarkably circular. What could make a shallow lake so remarkably circular, as are the rings? I do not know, unless the wind blew randomly, eroding the shores with wave action. Interestingly, 2 or 3 oval-shaped rings are known. Fig. 58 is a drawing, not a photograph, and the P.I. will check this analog out on aerial photographs at the Ottawa Depository.

As a contribution to science, Malcolm Kirk collected and identified 66 vascular plants in our field area, including a wild rose bush found atop a palsa (4). Two palsas found near the center of one ring were the only dry areas. These palsas are further evidence for a periglacial, permafrost-related origin for the rings. We carefully sampled seven 230 square meter plots on, in, and about a ring. But, as said above, it is ultimately the deep moat of peat that determines the plant assemblange on a ring's periphery.

The Carolina Bays have spawned scores of publications. Their origin is still in dispute. Hopefully, the P.I. may be forgiven if our limited field work has not solved the problem of the origin of the rings in Ontario. In closing, the P.I. wishes to point out that his 15 year old son Harlow (yes, named after Harlow Shapley, my astronomer friend) carried his load of the work commendably. He was a volunteer worker.

REFERENCES

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(4) Sparling, J. (1973) Ontario Naturalist, p. 5-9.

(5) Bird, B. (1967) The Physiography of Arctic Canada, p. 213. The Johns Hopkins Press, Baltimore, Maryland.