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THE INFLUENCE OF PREHISTORIC MAN ON THE DISTRIBUTION OF THE BOX TURTLE

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INTRODUCTION

The Eastern Box Turtle (*Terrapene carolina*) has a wide distribution throughout eastern North America from Maine to Florida, and west to Texas. It is a common and conspicuous element of the fauna, but its distribution at the northern edge of its range has been difficult to determine, in part because this turtle is so often kept as a pet and then released beyond its natural range. This report is a re-evaluation of distributional records for this species from Wisconsin to Maine based on the large body of archeological data now available from this area. Accurate determination of the present range is prerequisite for a discussion of the various factors, including man, that have altered the distribution of this turtle.

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Fossil Records

Fossil material of this turtle is extensive, but is in large part only from two areas (Florida and Texas), both in the southern part of the range (Auffenberg, 1958, 1967; Milstead, 1969). Very few records are available from the northern part of the range that could give a clue to the distribution of this species during glacial and interglacial periods. Turtles like *T. carolina* are known from the upper Pliocene and Pleistocene of Florida (Auffenberg, 1958, 1967), and the Pleistocene of New Mexico, Texas, Kansas, Arkansas, and Missouri (Milstead, 1967). Although the box turtle still exists in most of Florida, the records from southern Texas, western Kansas, and eastern New Mexico, which are beyond the present range, suggest a more southern and western distribution limit during the Pleistocene. During this period or earlier, the Texas populations were doubtless in contact with others to the south in Mexico that now have become morphologically distinct and disjunct (*T. carolina mexicana*, *T. c. yucatana*, *T. coahuila;* Milstead, 1967). *Terrapene* is well known from archeological sites in Yucatan dating from the Pleistocene (Langebartel, 1953).

Fossil *T. carolina* are reported from only five localities in northeastern North America: two each in Pennsylvania (Fig. 1) and Virginia, and one in Maryland. Both Virginia localities are of late Wisconsin age: Natural Chimneys (Augusta Co.; Guilday, 1962b) and Early's Pits (Wythe Co.; Guilday, 1962a). The Maryland locality is Pleistocene in age (Talbot Co.; Milstead, 1965). The oldest Pennsylvania record is from Port Kennedy Cave (Montgomery Co.; Milstead, 1965), which is of Yarmouth age. Guilday *et al.* (1966) suggest a minimum date of about 1770 ± 200 years B. C. for the Bootlegger Sink *Terrapene* (York Co., Pennsylvania). The Bootlegger fauna contains both temperate and boreal elements and is undoubtedly the result of a long period of deposition. The box turtle, judging from its low fluoride content, was probably a late addition to the deposit. In contrast, the extensive excavations at New Paris Cave no. 4 (Bedford Co., Pennsylvania), dating 9345 ± 1000 B. C., failed to disclose this species (Guilday *et al.*, 1964), and it did not turn up at Frankstown or Cumberland caves, both Pleistocene assemblages (N. D. Richmond, pers. comm.). These records, although few in number, establish the presence of *Terrapene* as far north as southern Pennsylvania during at least some periods of the Pleistocene.

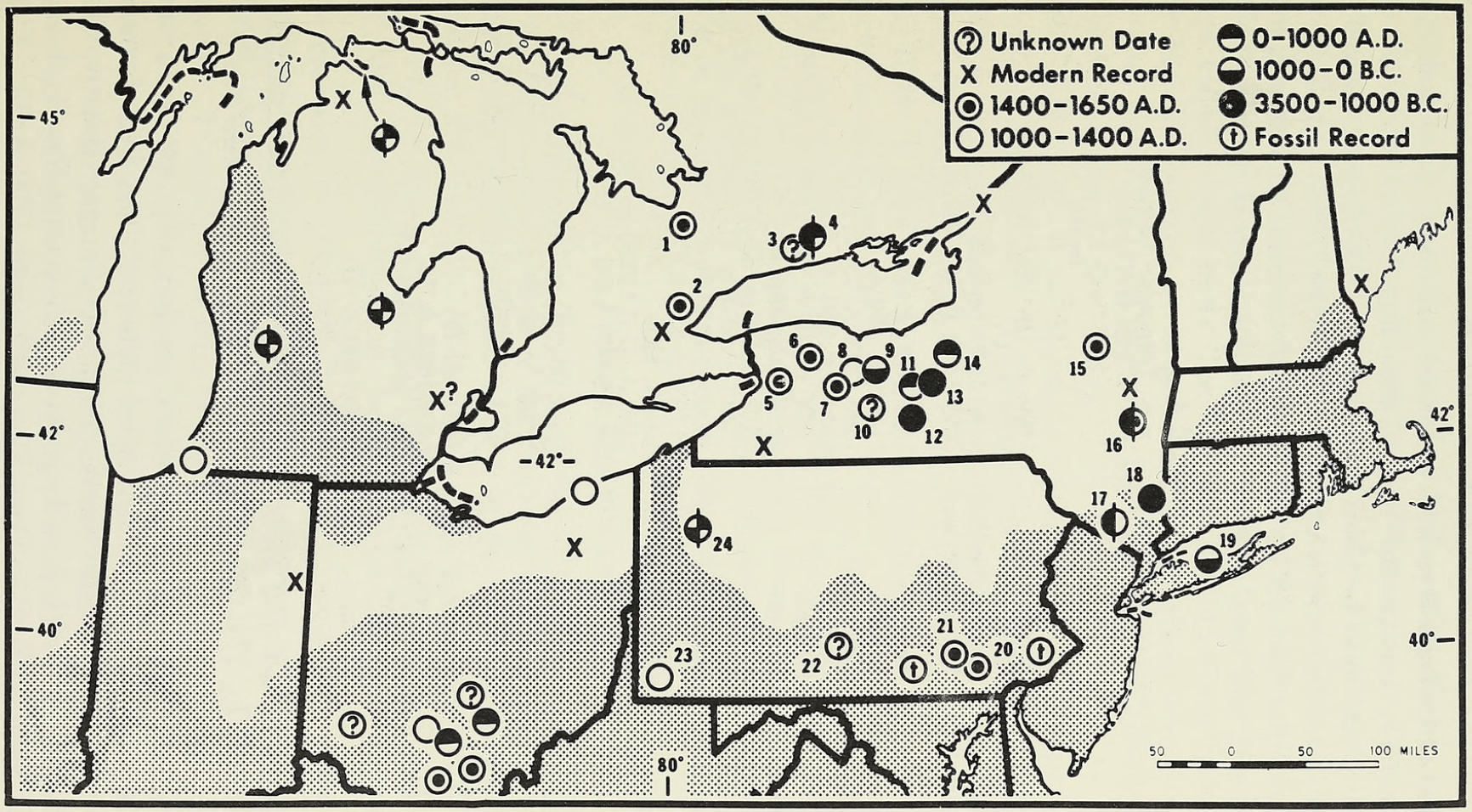

Fig. 1. Distribution of the Eastern Box Turtle (*Terrapene carolina*) in northeastern North America. Stippling indicates the modern distribution; single-specimen extralimital records are indicated by X. Archeological and fossil records are indicated by circles. Circles bisected by a vertical line represent multicomponent sites with occupations of two widely different ages. Numbers identifying sites refer to Table 1.

ARCHEOLOGICAL RECORDS

Fossil and archeological records are listed separately, since prehistoric man occasionally transported turtles, including box turtles, and this means of dispersal must be taken into account. Archeological records for *T. carolina* in northeastern North America (Adler, 1968; table I, fig. 1) represent material from refuse pits or burial mounds. I have seen most of this material, and have particularly examined critical records.

TABLE 1

ARCHEOLOGICAL RECORDS FOR *Terrapene carolina* IN ONTARIO, NEW YORK, AND PENNSYLVANIA

SITE	COUNTY	DATES
ONTARIO		
1 Sidey-Mackay	Simcoe	1400- A. D.; 1591 A. D.
2 Lake Medad	Halton	1600 A. D.
3 East Gore	Northumberland	date undetermined
4 East Sugar Island	Northumberland	2000-1500 B. C.; 300 A. D.
NEW YORK		
5 Kleis	Erie	1620-1640 A. D.
6 Oakfield	Genesee	*1509 ± 150 A. D.
7 Dutch Hollow	Livingston	1590-1615 A. D.
8 Sackett	Ontario	*1140 ± 150 A. D.
9 Morrow	Ontario	*630 ± 100 B. C.; *563 ± 250 B. C.
10 Bristol Hills	Ontario	date undetermined
11 Kipp Island-2-3	Seneca	*310 ± 100 A. D.; *630 ± 100 A. D.
12 Lamoka Lake	Schuyler	*3433 ± 250 B. C.; *2575 ± 400 B. C.
13 Frontenac Island	Cayuga	*2980 ± 260 B. C.; *2013 ± 80 B. C.; *1723 ± 250 B.C.
14 Felix	Onondaga	500 A. D.
15 Garoga	Fulton	1550 A. D. (*1330 ± 100 A. D.)
16 Zimmerman Rockshelter	Greene	2200 B. C.; 1400 A. D.
17 Dutchess Quarry	Orange	2500-1500 B. C.; 1000-1400 A. D.
18 Vosberg	Dutchess	*2780 ± 80 B. C.
19 Stony Brook 2	Suffolk	*974 ± 250 B. C.; *944 ± 250 B. C.
PENNSYLVANIA		
20 Ibaugh	Lancaster	1400- A. D.
21 Eschelman	Lancaster	1400-1625 A. D.
22 Sheep Rockshelter	Huntingdon	date undetermined
23 Varner	Greene	1000-1400 A. D.
24 Quaker State	Venango	100 B. C.-900 A. D.

C-14 dates are preceded by an asterisk; others are estimates based on associated archeological material. In some cases, these dates may be accurate only for the *Terrapene*-bearing component. Dates are from Ritchie (1965) and Ritchie, Guilday, and Wright (pers. comm.). Numbers correspond to sites in Fig. 1; details for Michigan and Ohio records are in Adler (1968).

Box turtles (or "land tortoises, *Cistudo*" as they often appear in some of the archeological and older zoological literature) have been found at archeological sites in the northeast dating over the past five thousand years. The oldest record is from Lamoka Lake in central New York (site dated 3433 to 2575 B. C.). From then until about 1700 A. D. (Kleis,

Oakfield, Dutch Hollow, and Garoga sites) they were locally common in western New York, southeastern New York, and southern Ontario, areas largely beyond the present range of the species. In Pennsylvania all archeological records fall within, or only a few miles beyond, the present range (Fig. 1). Farther west, there are a few archeological specimens from beyond the present range in Ohio and Michigan, but in each case they were used as bowls and thus could have been introduced into these areas via inter-tribal trade. The two extralimital records from Michigan are each represented by a single fragment. These records and some material from Wisconsin originally misidentified as *T. carolina* are discussed elsewhere (Adler, 1968).

Box turtle artifacts are also known from four sites in southern Ontario (Table 1). In all cases, however, the specimens have been made into bowls or rattles, so the possibility exists that these may have been introduced via trade. However, one of these localities (Lake Medad; Bleakney, 1958) is very near the place where the single modern Canadian specimen was found (see below).

The archeological records indicate the widespread occurrence of the box turtle in northeastern North America since about 3000 B. C., and suggest a reduction of its range in New York and possibly Ontario since 1700 A. D. The possible causes of this reduction will be discussed in more detail below.

PRESENT DISTRIBUTION

Conant (1958) gives the most recent map for the range of the box turtle. After careful review of the literature and new records, and after consideration of each of these in view of the abundant archeological information now available (Adler, 1968; table 1), I have drawn up a new map (Fig. 1). There are significant differences between this and Conant's map, and these differences are briefly discussed below.

NEW ENGLAND

The box turtle ranges through the maritime provinces of New England to and including the southern tip of Maine. There are no records for Vermont. The only two records for New Hampshire are old (Huse, 1901), and both in the maritime part of the state. There is a single, old record from Maine (York Co., A. A. Barden, pers. comm.). Surveys in other parts of the state, including offshore islands, have not found it. However, box turtles are known from two islands off the Massachusetts coast: Martha's Vineyard (personal record) and Nantucket Island (MCZ

46174). Both islands were apparently separated from the adjacent mainland about 2000 B. C., according to botanical and zoological evidence (Ogden, 1958; Starrett, 1958). These two islands are located 5 and 20 miles, respectively, from the Cape Cod mainland. If these turtles did not swim these distances or were not transported by humans, this species has been present on these offshore islands (and presumably on the adjacent mainland) for nearly 4000 years.

NEW YORK, PENNSYLVANIA AND ONTARIO

Within historic times, the box turtle has never been listed as common in New York state except in the southeastern corner. Mearns (1898) said it was common along the lower Hudson River, from the Fishkill Mountains and Storm King Mountain (Putnam Co.) southwards. There are numerous records from Long Island (Latham, 1916) and Staten Island (Davis, 1912). Farther up the Hudson, there are two old records from near Albany (Eights, 1835; Baur *in* Taylor, 1895). It has apparently disappeared in that area since, as Bishop (1923) recorded no further specimens. The only historic record for western New York is a single specimen from Allegany State Park (Cattaraugus Co.; Eaton, 1945), although Bishop and Alexander (1927) did not find it in their extensive survey of the Park. Werner (1959) reported a specimen from Ironsides Island (Jefferson Co.), an island in the headwaters of the St. Lawrence River.

In Pennsylvania, *T. carolina* is not known from the northern half of the state, except along Lake Erie and near the Ohio Border. Since this turtle is not common at high elevations in mountainous regions, it seems unlikely that the western New York and Ontario populations of prehistoric times were derived from eastern New York, although the "Water Level Route" across central New York could have been used as an invasion route. It seems more likely that these populations reached this area via the low plains along the shore of Lake Erie, since the archeological records are more consistent with this hypothesis.

There is only one modern record for Ontario (and Canada), previously unreported, from 5.2 miles east of Alberton: "there was nothing about the turtle that might have led me to suspect that it had been a captive" (C. M. Bogert, pers. comm.). The proximity of this locality to an archeological site for *T. carolina*, namely Lake Medad, lends some support to the belief that this is a natural record.

OHIO, INDIANA AND MICHIGAN

The distribution of the box turtle in Ohio and Indiana is apparently not as continuous as currently thought. I can find only two seemingly authentic records for a broad belt of land from the Pennsylvania border to and including east-central Indiana. Dexter's (1955) record for Portage County, Ohio, was for a specimen actually collected in Carroll County farther south, and within the natural range of the species. However, his earlier record (Dexter, 1948) of a single specimen from Twin Lakes (Portage Co., Ohio) appears authentic. *T. carolina* is known from several Cleveland parks (Cuyahoga Co.) but these records are discounted since the species is absent from other areas beyond the city limits. *T. carolina triunguis* (a form found generally west of the Mississippi River) has also been taken in these same parks. It and *T. c. carolina* have both laid eggs there, and newly-hatched juveniles of both were found in the parks in 1959 (C. Strong, pers. comm.). Box turtles are absent on the Lake Erie islands (Langlois, 1964), although they are abundant on the adjacent Ohio mainland.

The only apparently authentic record for east-central Indiana is a single specimen collected in Adams Co. in 1953 (UMMZ 108078). Extensive collecting by many persons in this region and in the part of Ohio mentioned above has failed to turn up additional specimens. Actually, there is no fossil or archeological evidence to show that this turtle was ever native to this region. Today, this area is largely under cultivation, and the moist forests that *T. carolina* typically frequents have been reduced or eliminated. It is possible that the drying conditions of the Xerothermic Interval contributed to the demise of this turtle in these parts of Ohio and Indiana, if it ever occurred there at all.

In Michigan, the box turtle is known from the southwestern half of the lower peninsula. The most northern record along Lake Michigan is a specimen from Benzie County (UMMZ 108890) collected in 1953. There is only one record farther north, a single specimen collected during four summers of field work at Douglas Lake (Cheboygan Co.; Ellis, 1917), site of The University of Michigan's biological station. Continuous collecting in this region since that time has failed to turn up an additional specimen (F. H. Test, pers. comm.).

The northern distribution of the box turtle in Michigan (nearly to 45° North latitude) is of particular interest because it reaches only to about 43° North latitude on the Wisconsin side of Lake Michigan. Presumably, the temperature-moderating influence of the lake (caused by the high

specific heat of water) provides a more suitable climate on the eastern shore. The effective growing season is extended well into the fall on the eastern shore, which has resulted in a flourishing agricultural "fruit belt" in this region. In fall and winter, the temperature of the prevailing westerlies is often raised as much as 20° F. before these winds reach the eastern shore (Wills *in* Hambridge, 1941). In spring, the warm southwesterlies are cooled as they pass over the lake. The main effect is the delay of plant development — and perhaps emergence of terrestrial animals — until such time as the frequency of killing frosts is much reduced. Only a few of the terrestrial and aquatic vertebrates found on both sides of the lake show a more northerly distribution in Michigan. I do not have sufficient information on birds to comment on their distributions or times of migration on both sides of the lake. None of the fish or mammals shows a more northerly range limit in Michigan, except for a mole, *Scalopus aquaticus* (see Burt, 1964), but there are several examples among *terrestrial* amphibians and reptiles. The most striking instances are the box turtle, spotted turtle (*Clemmys guttata*), and Fowler's Toad (*Bufo woodhousei*). In fact, the northern limits of the ranges of these three forms are almost exactly the same east of the Mississippi River, even to minute details of distribution (compare ranges in Conant, 1958, Logier and Toner, 1961; Adler, 1968). In each of these, the distribution around Lake Michigan is alike, the range in Michigan extending nearly to the Upper Peninsula in the western part of the state along the lake. It is possible that these three forms have some similar sensitive point in their life histories that accounts for the resemblance in their northern distributions in this region. During the spring, they live in rather different habitats: *Bufo* in temporary pools and streams, *Clemmys* in permanent ponds and marshes, and *Terrapene* on land. The moderating influence of Lake Michigan would be expected to have rather different effects in each of these habitats. In the fall, however, the habitats of the three are similar, in that all are terrestrial. All three hibernate on land, including *Clemmys* (Netting, 1936). If a common limiting factor like temperature exists, the effects on the three species might be expected to be more uniform in the fall when all exist in similar habitats. I suggest that the absence of early killing frosts in the fall (in western Michigan as opposed to Wisconsin) might allow them a longer period in which to find a suitable site to bury themselves and successfully hibernate. Box turtles, for example, bury themselves in a slow, stepwise fashion requiring several days or weeks to complete. A killing frost or two in rapid succession could

kill such an animal before it could dig deep enough to effectively hibernate.

ILLINOIS AND WISCONSIN

In Illinois, Smith (1961) records *T. carolina* from the southern half of the state. There are no fossil, archeological, or modern records for the northern half.

The presence of this species in Wisconsin has been a matter for debate. Some authors (for example, Dickinson, 1965) have confused the eastern and western box turtle (*T. ornata*), and their records are thus useless. Higley (1889) reported two specimens of *T. carolina* from Walworth County, and Cahn (1929) mentions one from nearby Waukesha County. Both appear valid. It is doubtful that *Terrapene* were carried about and released in Higley's day as much as they are today.

DISCUSSION OF MODERN DISTRIBUTION

The modern limit of distribution for *T. carolina* from Wisconsin to Maine, as here understood (Fig. 1), is uneven. Its northward presence along the eastern shore of Lake Michigan may be due to the tempering effects of the lake, and its presence in maritime Maine and New Hampshire may be due to similar moderating effects of the North Atlantic. The absence of the box turtle in large portions of Ohio and Indiana, and in northern Illinois, may be due to effects of the dry Xerothermic Interval, although there is no fossil or archeological evidence to show that box turtles ever inhabited this area. The present limited distribution of this species in New York and Ontario, and its more widespread occurrence there in prehistoric times, seem not to be explained by any of these influences. The probability that some other factor is involved, namely man, is discussed below.

DISTRIBUTIONAL CHANGE IN NEW YORK AND ONTARIO

We must first consider the possibility that introduction of the archeological specimens of *T. carolina* was via inter-tribal trade, and that the species was never native to western New York or Ontario. This possibility is considered remote since specimens are present in large numbers at many widespread localities. In at least half these places they were used for food purposes, since unworked shells and limb bones, many of them charred, have been found in several New York middens. While it is possible that some of the worked material was introduced, it is doubtful that the Indians of this region would have imported turtles for food when

deer and other game species were plentiful locally. Indeed, the Indians of this area, particularly those of Late Woodland times, were noted for their independence and virtual lack of trade with outside tribes (Ritchie, 1965). It is true that seashells, shark teeth, Ohio flint, and other objects were imported via trade, but there were no substitutes for these items in western New York. Thus, the specimens of this turtle recovered from burials and middens are assumed to have been collected from resident populations.

INFLUENCE OF CLIMATE

Changes in the ranges of organisms over time periods are often explained on the basis of climatic factors, especially when there are coincident changes in the ranges of different forms. A unique change in a single species' range, like that which has occurred in the instance of the box turtle, is more difficult to explain. Today, the box turtle is found in three regions (Wisconsin, Michigan and New England; Fig. 1) at more northerly latitudes (above 42°) than those in which it occurs in New York. There are no obvious climatic factors, either now or since the Pleistocene, that would simultaneously explain the absence of these turtles in New York state, where they once occurred, and their presence elsewhere at more northern latitudes. The possible tempering effects of large bodies of water may account for the presence of box turtles so far north in Michigan and New England. Why then are these turtles absent today around other large bodies of water such as Lake Ontario (where box turtles once occurred)? Box turtles may well have entered New York during the warm, moist Climatic Optimum, as Guilday (*in* Ritchie, 1965) suggests. The later Xerothermic Interval, with its dry, prairie-like conditions, may have been instrumental in eliminating this turtle from certain parts of the Midwest, but probably did not affect populations farther east in New York. This turtle persisted in New York long after the termination of the Xerothermic Interval.

More gradual climatic changes also do not seem to be implicated as a cause for extinction in western New York. A comparison of pollen profiles from western New York (where box turtles disappeared) with those from New England (where the box turtle persists) suggests more dramatic changes in climate in the *latter* area. The time-span of interest is contained within the C-3 pollen zone, a sequence of deposition extending from about 100-0 B.C. to the present time (Davis, 1965). C-14 dates are not available from all profiles, nor is the C-3 zone equivalent in age at all sites under consideration. Nevertheless, the C-3 profiles are approxi-

mately of equal age and if they are not truncated, should give a view of floral (and climatic) conditions over this time period. An increase in the percentage of non-arboreal pollen, such as *Plantago* and Compositae, is assumed to indicate the effect of European forest clearance and, thus, a fairly complete, non-truncated C-3 zone. With these limitations, I have compared profiles in Vermont (Davis, 1965) and eastern New York (Cox, 1959) with those from west-central New York (Cox, 1959). None of these profiles appears to be truncated.

Since *T. carolina* is an inhabitant of open, deciduous woods (typically beech-maple; Stickel, 1950), particular emphasis is placed on the relative abundance of *Fagus* and *Acer*. Although hemlock is not commonly associated with *Terrapene* habitats in regions south of New England, this tree is a good indicator of moisture. It is present in all profiles considered here and is used to give a relative idea of moistness. In all profiles examined, the abundance of *Fagus* steadily decreases in C-3. In west-central New York (Bull Head Pond, Mud Lake-Tully, Perch Lake, McLean Bog), *Fagus* pollen gradually decreases in abundance, eventually reaching 35 per cent to 70 per cent of its maximum abundance in C-3. In eastern New York and Vermont (Mud Lake-Jordanville, Consaulus Bog, Chestertown Bog, Brownington Pond), *Fagus* also decreases in abundance, reaching 15 per cent to 40 percent of its maximum abundance in C-3. *Acer* pollen is less abundant in all these profiles but shows similar trends from west to east. *Tsuga* is more abundant and, in general, decreases in frequency during the C-3 zone.

These data suggest a warming and drying trend throughout the New York-Vermont region during the last 2000 years, but the trend is more rapid and pronounced in the East. If the box turtle is sensitive to such changes in climate, one would expect it to be most responsive in eastern New York and New England. Nevertheless, box turtles persist in the East and it follows that they would be expected to survive the apparently less drastic changes that occurred in western New York. Thus, it appears that such climatic changes were not directly responsible for elimination of the box turtle in western New York.

INFLUENCE OF MAN

A more plausible explanation for the box turtle's disappearance in the Lake Ontario region involves the relationship between these turtles and the Indians of this area. The box turtle was important to the Iroquois and certain cognate tribes, and the time and place of its elimination is closely correlated with the chronology of prehistoric cultural development in the

Lake Ontario region (Ritchie, 1954). Of all the Indian tribes of eastern North America, those of New York and Ontario had the longest and most intensive interest in box turtles. Judging from the burials and middens in New York state, predation on this species was intense and included both adult and juvenile specimens. At Archaic and Early Woodland sites (dating from 3500 to 0 B.C.), these turtles were used for food and as ceremonial objects as well, but mostly for the former purpose. At most sites where turtles were recovered, box turtle was the species most commonly eaten, although the amount of meat per specimen is far less than in several of the larger aquatic species. This use is in contrast to specimens from Middle and Late Woodland sites (0-1600 A.D.) where the majority were used in ceremonies.

The importance of the box turtle to Indians in the Lake Ontario region is particularly noticeable in the Iroquoian culture. *Terrapene* was the symbol of the earth or earth-bearer to the Iroquois and cognate Algonkian tribes. Consequently, it was much revered by them and was included among ceremonial objects in most burials, even those of women and children (Ritchie, 1954). Box turtles were used in many dances as ornaments and rattles (Ritchie, 1954), and in game-hunting to invoke the aid of the demons to capture prey (Fenton, 1941). In contrast, other Indian tribes of the time considered the turtle unimportant in religion or even despised the animal. Among the Indians in the western Great Lakes region, box turtles were rarely used in ceremonies; in many of these areas the aquatic Blanding's Turtle (*Emydoidea blandingi*) served this purpose (Adler, 1968). The Illinois and Miamis believed the earth was held up by an otter rather than by a "tortoise." Turtle eggs and small turtles were even considered a sign of bewitchment to the Hurons of Michigan and extreme western Ontario, although some turtles (but not *Terrapene*) were made into rattles and others occasionally used for food (Kinietz, 1940).

These Indians may also have affected box turtle populations in another, less-direct way. The popular belief that eastern North America was a continuous unbroken forest when the first Europeans arrived has been challenged by several recent authors (see Day, 1953). There can be little doubt that Indians, including the Iroquois, significantly altered these primeval forests. The Indians created large clearings for villages and agricultural fields. Their seasonal migrations and periodic relocation of villages extended their influence even farther. Women continuously foraged for firewood beyond the clearings and the men regularly fired the woods to drive game, to improve visibility for war purposes, and to

increase the supply of grass seeds. Such fires are typically fatal to terrestrial turtles and would be especially critical for juveniles with their less-protective shells. More important, perhaps, were the extensive clearings of land for cultivation of maize. The extent of these plots was often enormous, sometimes encompassing thousands of acres around a single village. The military expeditions into Iroquois country in the 18th Century often discovered large quantities of corn and grain. Sullivan's expedition in 1779 destroyed at least 160,000 bushels of corn in a series of small villages (Day, 1953). Thus, *Terrapene* were denied the use of a large portion of their former habitat since these clearings were usually made in forested valleys and lowlands.

The use of box turtles by New York Indians ended abruptly. As late as 1650 A.D., box turtles (and rarely the painted turtle, *Chrysemys picta*) were used as ceremonial objects (at the Kleis and Dutch Hollow sites, for example), but by contact times the Indians had switched to the snapping turtle (*Chelydra serpentina*), a large aquatic form. This species was relatively common in archeological material dating from the earliest times but was then used solely for food purposes until it came into ceremonial use about 1700 A.D. The earliest record of worked *Chelydra* comes from a single burial at the Pen Site (Onondaga Co., New York; P. P. Pratt, pers. comm.), a site that was destroyed by Frontenac's invasion, about 1685-1696. Morgan (1904) illustrates a snapping turtle rattle used about 1800. The Senecas of western New York still use *Chelydra* rattles today (Fenton, 1941, pls. 17, 20, 23, 24).

The timing of this substitution cannot be precisely determined. Box turtles have been found in graves at Dutch Hollow (1590-1615 A.D.) and several nearby sites dating from 1550 to 1687 A.D. (Rochester Junction, Dann, Power House, Feugle, Adams, and Cameron, according to C. F. Wray, pers. comm.; none of these is mapped in Fig. 1 but they are near locality 7). It is perhaps significant that the frequency of box turtles in these graves is much lower than at many earlier sites in this area. At Dutch Hollow, only 7 of 272 graves had box turtles (Ritchie, 1954) and at Rochester Junction, only 4 of 120 (Wray, pers. comm.). In addition, there is no evidence in these later excavations that box turtles were used as food, although they were commonly eaten as late as Oakfield and Zimmerman times (1400-1500 A.D.). This suggests growing scarcity of this turtle from 1500 to 1700 A.D. Some of the records of box turtles in the most recent gravesites could represent specimens that had actually been collected many years previously and made into artifacts.

It is possible that European man's agricultural activities had some additional effect since the first pioneers in western New York arrived about 1800 (Gordon, 1940). I consider this event less likely to be the cause of the turtles' disappearance than Indian influence, for two reasons. First, the box turtle populations were apparently already decreasing in size before 1700. Second, European cultivation in New England had seemingly not affected the box turtle populations there, at approximately the same latitude and at the edge of the species' range.

Amount of Predation

To anyone familiar with the high population densities of *T. carolina* in many regions it may seem naive to consider it possible that prehistoric man could be responsible for this turtle's elimination in a region as large as western New York state and parts of Ontario. But several facts should be considered. First, the Lake Ontario region represented, originally, the range limit for this species and, as is true for most organisms, the densities were probably reduced at the edge of the range where habitat is presumably less favorable. The box turtle was apparently never widespread in western New York, but rather localized in distribution and restricted to lowland areas. This is coupled with primitive man's steady, selective predation for 5000 years, becoming most intensive during recent Iroquoian times; there was a marked Indian population increase about 700-900 A.D. with the development of maize agriculture (J. B. Griffin, pers. comm.). I do not think it is mere coincidence that box turtles disappeared from precisely that portion of eastern North America where human predation was most intense, especially when these events are correlated temporally as well as geographically.

Fenton (1940) has estimated the population sizes of the various Iroquoian tribes at contact times, from which we can get a rough estimate of the amount of predation on box turtles for burial artifacts. These population figures are undoubtedly underestimates since European diseases and disruption of primitive economic patterns preceded the first observers (Day, 1953). The Five Nations of the Iroquois Confederacy, which occupied a part of western New York state, numbered at least 7000 persons when the first Europeans arrived (Fenton, 1940). If we assume that the population size was stable (including a stable age distribution) and further, that an average Indian lived 30 years, this means that 1/30th of the population, or 233 individuals, died each year. Although box turtles were buried even with women and children, not all

graves contain shells. Possibly many shells did not survive the ravages of decay (Ritchie, 1954). Nevertheless, except for the most recent burials, some individual graves had a dozen or more shells. If there was an average of one shell per grave, this means a predation of only 233 box turtles per year in this region, a relatively small number. However, this number represents only one type of predation on the box turtle. If we add to this (1) the predation of other contemporary tribes (Hurons, 30,000 persons; Neutrals, 12,000; Eries, 8,000-10,000, at contact times), at least in part of whose territory box turtles once lived; (2) the added predation among Iroquoian and cognate tribes for food, medical, ceremonial, and hunting purposes; (3) the sustained and selective predation on box turtles for some 5000 years; and (4) perhaps most important, the destruction of much of the turtle's original habitat, then the full effect of this predation and disruption of habitat seems evident.

Thus, present evidence suggests that the box turtle, an easily collected and especially sought-for species, was eliminated in western New York by the Iroquois Indians, a situation similar to the earlier Pleistocene extinctions of large mammals apparently perpetrated by man (Martin and Wright, 1967). The porcupine (*Erethizon dorsatum*) may likewise have been eliminated in Tennessee by Indians who prized the quills (Parmalee and Guilday, 1966). In contrast, the rice rat (*Oryzomys palustris*) took advantage of the spread of Indian maize agriculture to extend its distribution northward about 1000 A.D. (Goslin, 1951; Smith, 1965). All these cases point to the importance of primitive man in altering postglacial distributions of certain species.

SUMMARY

In northeastern North America, the range of the box turtle (*Terrapene carolina*) currently extends to central Pennsylvania, the lower Hudson Valley of New York state, most of Massachusetts, and into southern Maine. From 3500 B.C. until 1650 A.D., however, the range was more extensive in this area, extending up the Hudson Valley and including most of the western part of New York state and possibly southern Ontario. Evidence suggests that prehistoric man, primarily Iroquoian Indians, was responsible for elimination in these last-named areas.

Today, the box turtle is found in three areas at more northerly latitudes than those in which it occurs in New York: Wisconsin, Michigan, and New England. Each of these three areas had resident Indian populations, but unlike those in New York state, these Indians used box turtles only rarely. In western New York and southern Ontario, predation for food

and ceremonial purposes began as early as 3433 ± 250 years B.C. (Lamoka Lake site) and became most intense after 700 A.D. with the development of the Iroquoian culture. Burials, including those of women and children, sometimes contain up to a dozen specimens. Added to this was the predation for food, medical, ceremonial, and hunting purposes. Perhaps more important was the Indians' destruction of the turtles' habitat, primarily for cultivation of maize. As late as 1650 A.D. (Kleis and Dutch Hollow sites) box turtles were still in use, but by 1700, snapping turtles (*Chelydra serpentina*) had replaced them in burials.

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