

SHORT NOTES

NOTE ON THE "ARIKAREE STADE" OF THE ROCKY MOUNTAINS NEOGLACIAL

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ABSTRACT. Neoglacial deposits in the Indian Peaks section of the Colorado Front Range have been dated lichenometrically by recourse to a growth-rate curve developed for *Rhizocarpon geographicum* and three glacial fluctuations of the Temple Lake (4 500–2 700 B.P.), "Arikaree" (1 900–1 000 B.P.) and Gannett Peak (300–50 B.P.) have been recognized and identified by Benedict (1968). Recent soil investigations on neoglacial deposits suggest the need to define an alternative type "Arikaree" in the Indian Peaks.

RÉSUMÉ. Note sur le stade "Arikaree" du néoglaciale des Rocky Mountains. Les dépôts néoglaciales dans le secteur des Indian Peaks du Colorado Front Range ont été datés par lichenométrie en utilisant une courbe de croissance établie pour *Rhizocarpon geographicum* et trois oscillations glaciaires du et temple Lake (4 500–2 700 avant nos jours), d "Arikaree" (1 900 à 1 000 ans avant nos jours) et de Gannett Peak (300 à 50 ans avant nos jours) ont été reconnues et identifiées par Benedict (1968). Des récentes recherches sur les sols dans les dépôts néoglaciales font penser qu'il y aurait lieu de définir un nouveau type "Arikaree" dans les Indian Peaks.

ZUSAMMENFASSUNG. Bemerkung zum "Arikaree-Stadium" im Jungglazial der Rocky Mountains. Jungglaziale Ablagerungen im Gebiet der Indian Peaks in der Colorado Front Range wurden mit Hilfe einer für *Rhizocarpon geographicum* entwickelten Kurve der Wachstumsgeschwindigkeit lichenometrisch datiert und die drei glazialen Stadien Temple Lake (4 500–2 700 vor der Gegenwart), "Arikaree" (1 900–1 000 v.d.G.) und Gannett Peak (300–50 v.d.G.) wurden von Benedict (1968) erkannt und identifiziert. Neue Bodenuntersuchungen in jungglazialen Ablagerungen legen die Notwendigkeit der Definition eines alternativen Typs des "Arikaree"-Stadiums in den Indian Peaks nahe.

THE two glacial fluctuations of the Temple Lake (4 500–2 700 B.P.) and the Gannett Peak (300–50 B.P.) "stades" have been recognized for some time in the Central Rocky Mountains (Richmond, 1965, p. 226–27) and are now generally accepted. More recently, Benedict has defined an intermediate "stade" (the "Arikaree") which he dated by means of a growth-rate curve for *R. geographicum* at between 1 900 and 1 000 years B.P. (Benedict, 1968, p. 82–84). Recent work on soils in the Indian Peaks section of the Front Range, where the Arikaree was first recognized, supports its existence but suggests the need for an alternative type locality rather than that defined by Benedict (1968, p. 79) as: "a prominent pro-talus rampart [on the east flank of Navajo Peak] overlooking Arikaree Glacier". Soil facies on the pro-talus rampart do not appear representative for "Arikaree" deposits in the Indian Peaks.

Deposits of "Arikaree" age are morphologically and topographically very similar to the younger deposits of Gannett Peak age. In many cases, the "Arikaree" moraines are partially buried beneath younger ones and it is generally difficult to distinguish the two on superficial analysis. More detailed work on 18 soil profiles developed on deposits of "Arikaree" age, however, provides the following description for a post-"Arikaree" soil:

A1 10 YR 4/1 color, 7.5–25 cm thickness, loamy sand texture, single grain structure and friable moist consistency. pH 4.5–5.5.

Cox 10 YR 5/3 color, 25–38 cm thickness, loamy coarse sand, massive structure, loose to very friable moist consistency. pH is generally 5.5–6.5. Boulders, cobbles and pebbles are found throughout the soil profile.

Post-"Arikaree" soils have facies which range from A/Cn to o/A11/A12/Cox development. Particle-size data tend to show an accumulation of fine-grained material in the sub-surface where clay reaches 11% in topographically high positions. In topographically low positions, clay reaches 30% in the sub-surface. Clay-mineral analyses point up the occurrence of chlorite, illite, kaolinite, montmorillonite and mixed layer lattices. The data tend to show differences from younger post-Gannett Peak soils in the accumulation of montmorillonite in the sub-surface, an apparent function of time and the effect of leaching within the soil profiles. The organic profiles show average values of 1.2% for organic matter in surface horizons of post-"Arikaree" soils, more than twice the average values for post-Gannett Peak soils. The data show no difference in per cent N between post-"Arikaree" and post-Gannett Peak soils.

The name "Arikaree" has been pre-empted by Miocene sediments and will have to be renamed. This "stade" had not previously been reported in the Rocky Mountains and there is some controversy about its magnitude. Since the amplitude of glacier oscillation is less than 16 km, it may prove more appropriate to assign the magnitude of "sub-interval" in lieu of "stade", for all phases of the neoglacial (Morrison, 1968, p. 26).

The type locality for post-"Arikaree" soils is a lateral moraine on the north flank of Arapaho Cirque. The deposit has been mapped by Benedict (1968, p. 80) and by Mahaney (unpublished, pl. 2), and is associated with the youngest moraines of Gannett Peak age. Topographically and morphologically, this deposit looks very similar to the youngest moraines, especially with respect to its sharp crest, steep slopes and absence of appreciable vegetation. However, both lichens and soil development provide evidence of greater age. The soil developed on this deposit closely approximates the average characteristics for the post-"Arikaree" soil and supports the choice of an *alternative type locality*.

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