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## Counting Sheep Rocks

**Q.** *I am struck by the beauty of the dark, rugged outcrops that jut from Central Park's grassy, sculptured slopes. Were they placed there by the park's 19th-century landscapers, or are they part of the natural terrain?*

**A.** The ancient outcrops are the only element of Central Park that is not man-made, and they predate the designs of Frederick Law Olmsted and Calvert Vaux by about 450 million years. To ponder them is to gaze back in time at the deeply eroded remnants of mountains that were once as prominent as the Himalayas are today.

The park's rocky knolls are composed of metamorphic and igneous bedrock — primarily mica schist, gneiss, granite and metamorphosed oceanic material — which formed at the core of a mountain range that was pushed up when eastern North America collided with volcanic terrain about 450 million years ago, according to Charles Merguerian, a professor of structural geology at Hofstra University. This continuous spine of crystalline bedrock, called the "Manhattan Prong," runs just below the surface of the island, sup-

porting the weight of skyscrapers and emerging from the earth in Central Park and areas north of it, like Coogan's Bluff and Inwood Hill.

In the area where Central Park now sits, the mountainous bedrock ridge — part of the earth's continuous outer crust — was greatly eroded by succeeding eons, Mr. Merguerian said. At least five great glacial ice sheets that advanced from the northwest and northeast during the Pleistocene epoch, 200,000 to 20,000 years ago, dramatically altered the terrain, scraping, gouging and rounding the contours of the exposed bedrock and scattering huge boulders on the landscape.

Mr. Merguerian explained that the grinding effect of the advancing ice mass transformed many of the Central Park outcrops into asymmetrical hulks called "roches moutonnées," or sheep-shaped rocks. The south, or "lee" side of these outcrops, which were downstream of the advancing glaciers, are steep and craggy, while the north, or "stoss," sides tend to be smoothly polished and striated.

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