in two thrust sheets for a distance of 26 miles. The reef complex consists of a lower dolomitic stromatoporoidal limestone (Cairn formation) overlain by well bedded aphanitic limestone (Southesk formation) which contain abundant non-skeletal grains locally mixed with fossil fragments. This reef is comparable to adjacent reefs in the mountains and to some of the subsurface reefs.

The depositional history of the reef has been reconstructed from the stratigraphy, reef geometry, and a detailed study of the well exposed south margin. Thin argillaceous and stromatoporoidal carbonates were deposited over the entire area (Flume formation). Thicker and more fossiliferous portions of the Flume occur beneath the margin of the overlying Cairn reef and appear to represent shoals on and around which organic growth flourished. Differential subsidence combined with a rising sea level drowned most of the stromatoporoidal platform. In the relatively shallow waters above the more positive portions of the basin, stromatoporoidal growth continued. Between 400 and 500 feet of thick, massive stromatoporoidal carbonates and detritus accumulated above these more positive areas, forming the Cairn biostromes of the Ancient Wall and adjacent reefs. The surrounding basin was partly filled with black, predominantly euxinic shales (Perdrix formation). A lowering of sea-level throughout the basin caused shallowing above the biostromal area. Thus the environment was changed to one of very shallow-water bank conditions in which fine carbonate sands and muds with a pelletoid texture (Southesk formation) were deposited.

Gradual subsidence permitted the accumulation of between 500 and 600 feet of carbonate sands. The Southesk bank is flanked by brachiopod limestones and shales which contain local, small, coral biostromes. These fossiliferous carbonates grade into thin-bedded calcareous shales and limestones (Mount Hawk formation) of the surrounding basin. Basin relief was gradually decreased by influx of terrigenous muds and fine carbonate muds and detritus derived from the bank. Further shallowing and basin-filling permitted lateral extension of the bank environment and associated carbonate sands. During the Sassenach transgression the bank was emergent and the margins were eroded slightly.

The abrupt variations in thickness and character at the reef margins indicate differential subsidence during and after accumulation of the reef complex. Thus both differential subsidence and changes in sea-level have exerted control on reef development.

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Basement in the Continental Interior of the United States

Buried basement rocks of the central United States are mainly plutonic granitic rock, mafic and felsic metamorphic rock, and diabase. Rhyolite, granitic rock, and gabbro-diabase form a discontinuous belt from eastern New Mexico to eastern Missouri. The 0.5 b.y. rocks in the Wichita Mountains, Oklahoma, are the result of the last major igneous event. The Ouachita structural belt is the southern limit of petrographic knowledge of plutonic rocks.

None of these rock groups bears a simple relationship to basement topography and isotopic age. The Black Hills uplift-Cambridge arch-Central Kansas uplift is underlain dominantly by metamorphic rock with ages ranging from 1.7 b.y. in the north to 1.2 b.y. in the south. Siouxia arch contains 1.4 b.y. granitic and metamorphic rock. Nemaha uplift is underlain by 1.2–1.5 b.y. granite. Diverse rock types of 1.2–1.4 b.y. underlie Amarillo uplift and Red River–Matador arch.

Several large gravity anomalies correspond to major basement structures. The Williston basin is bounded on the south and west by a series of major west- and northwest-trending gravity anomalies and on the east by a belt of south-trending gravity anomalies extending from Canada into the central Dakotas that coincides with the boundary between the 2.5 b.y. Superior and the 1.7 b.y. Churchill Provinces of the Canadian Shield. The Sioux formation (minimum age 1.2 b.y.) lies along the west-trending anomaly in southeastern and central South Dakota. Keweenawan basaltic and sedimentary rock coincides with the mid-continent gravity anomaly and extends nearly continuously from Lake Superior to northeastern Kansas. The prominent gravity feature along the Red River–Matador arch coincides with the boundary between 1.2–1.4 b.y. rocks in the central United States and the 1.0 b.y. rocks in Texas.

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Mineralogy, Petrology, and Geochemistry of Porphyries and Granitic Rocks at Great Bear Lake, Northwest Territories

The Precambrian region between Great Bear and Great Slave Lakes is characterized by large bodies of granitic rocks and quartz-feldspar porphyries. In Great Bear Lake area granitic rocks, about 1,800 million years in age, range in composition from granite to diorite. Some are high in potash and have the characteristics of rapakivis. Closely related to granitic rocks are large volumes of quartz-feldspar porphyries which exhibit the peculiarities of ignimbrites. These, when in contact with granitic rocks, are recrystallized but still retain evidence of volcanic origin.

Integration of field data, qualitative and quantitative mineralogy, and distribution of 19 trace elements from 250 samples suggests that the parent magma was acidic and that the phenomena of volcanism and plutonism are closely related, the difference between them being mainly the depth of activity.

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Survey of Diapirs and Diapirism

Diapirs, *sensu stricto*, are bodies of sedimentary material which have pierced (or appear to have pierced) overlying material as a result of their mobility at comparatively low temperatures. They are composed of evaporites, shales, mud, etc. and range in size literally from molehills to mountains and in age from Precambrain to Recent. They occur associated with marine as well as continental sedimentary sequences and in areas which have been subject to intense tectonic deformation, virtually no deformation other than basin subsidence or to all amounts of deformation in between. As a result of the numerous possible combinations of these different attributes, diapirs of many types occur dispersed over much of the earth. Among those structures which are considered to be forms of diapirs, some of the best known are the diapiric folds of Roumania; the piercement salt domes of the Middle East, the Gulf Coast of Mexico, the United States, and Russia; the salt diapirs of Australia, Europe, and South America; the salt stocks and salt walls of Germany; some of the salt anticlines of the Canadian Maritime Provinces and the western United States; the gypsum diapirs of the Cana-