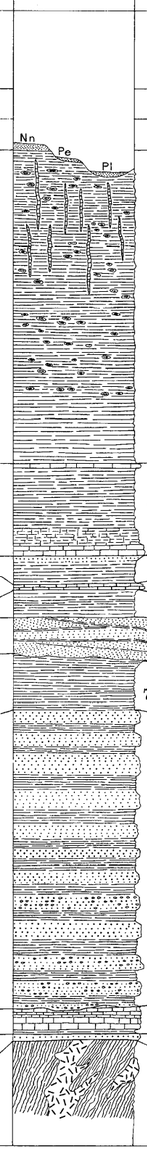
COLUMNAR SECTIONS

U.S. GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

COLORADO
PUEBLO SHEET

GENERALIZED SECTION OF THE ROCKS OF THE DISTRICT.

SCALE: 1000 FEET = 1 INCH.

Period.	Formation Name.	Symbol.	Columnar Section.	Thickness in Feet.	Character of Rocks.	Character of Topography.
Pleist.	Later alluvium.	Pl		10–40	Gravel, sand, and silt.	Bottom lands.
	Earlier alluvium.	Pe		10–40	Gravel, sand, and silt.	Terraces and mesas.
Neocene	Nussbaum formation.	Nn		20–100	Sand, gravel, and silt.	Mesas.
Cretaceous	Pierre shale.	Kp		2200+	Fine-grained gray shale; contains scattered columnar masses of limestone (tepee cores); also calcareous concretions, 1 to 3 feet across, with fossil shells.	Plains and slopes with occasional small buttes.
					Fine-grained gray shale with ferruginous concretions of lime and iron carbonates.	Plains and slopes.
					Gray shale with disseminated gypsum.	
	Niobrara formation.	Kn		600–700	Thin impure limestone. Gray shale with disseminated gypsum.	Small mesas and ridges. Plains and slopes.
					Light-gray calcareous shale. Pale-gray limestone.	Mesas and cliffs.
	Carlile shale.	Kcr		210	Yellow sandstone and gray shale.	Steep slopes.
	Greenhorn limestone.	Kgn		40	Light-gray shale and limestone.	Terraces.
	Graneros shale.	Kgs		200	Gray shale.	Valleys.
	Dakota sandstone.	Kd		300–650	Gray and white sandstone with beds of dark-gray, green, and chocolate shale.	High ridges (hogbacks) with cliffs.
Jura-Trias	Morrison formation.	Jm		70–400+	Variegated clays and shales with beds of limestone, sandstone, and gypsum.	Steep slopes.
Juratrias ?	Fountain formation.	Jf		2100+	Red, chocolate, and white, feldspathic sandstones; red and chocolate shales; and red conglomerates.	Deep rugged valleys.
Carb.	Millsap limestone.	Cm		200	Gray and purple limestone and shale.	Mesas and cliffs.
Sil.	Harding sandstone.	Sh		80	White sandstone.	Cliffs.
Arch. ?	Schist and granite.	Ars		?	Gray micaceous schists; gneiss; and pink granite.	Sloping plateau trenched by canyons.

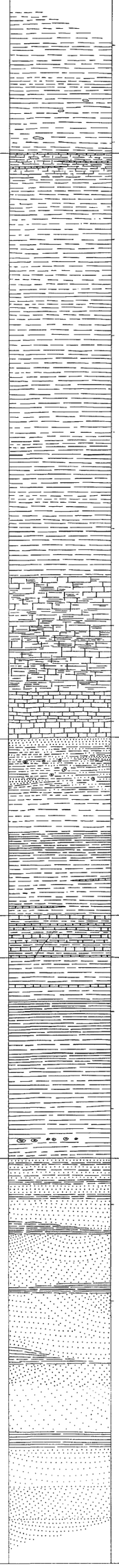
NOTE:—The right hand edge of the section column is drawn as the profile of an ideal cliff; the stronger beds, chiefly sandstones and limestones, project beyond the general face.

NAMES OF FORMATIONS—COMPARATIVE TABLE.

Period.	Names and Symbols used in this Folio.		Names used in Report on Underground Water, 17th Annual Report, U. S. Geol. Survey, 1896.	Cross: Pikes Peak Folio, U. S. Geological Survey, 1894.	Eldridge: Report on the Florence Oil Field, Am. Institute of Mining Engineers, 1891.	Hayden: Atlas of Colorado, 1881.
Pleisto-cene	Later alluvium.	Pl		Alluvium.	Quaternary.	Alluvium.
	Earlier alluvium.	Pe	Terrace sands and gravels.			
Neo-cene	Nussbaum.	Nn	Upland sands and gravels.			
Cretaceous				Montana.	Montana (comprising Fox Hills and Pierre).	Fox Hills (including also Fort Pierre).
	Pierre.	Kp	Pierre.			
	Niobrara.	Kn	Apishapa.	Colorado.	Colorado (comprising Niobrara and Benton).	Colorado (comprising Niobrara and Fort Benton).
			Timpas.			
	Carlile.	Kcr	Carlile.			
	Greenhorn.	Kgn	Greenhorn.			
	Graneros.	Kgs	Graneros.			
	Dakota.	Kd	Dakota.	Dakota.	Dakota.	Dakota.
Juratrias ?	Morrison.	Jm	Juratrias.	Morrison.	Jura.	Variegated Beds, etc.
	Fountain.	Jf		Fountain (classed as Carboniferous).	Trias.	Red Beds, etc.
Carb.	Millsap.	Cm		Millsap.	Carboniferous.	Carboniferous.
Silu-rian	Harding.	Sh		Harding.	Silurian.	
Arch-ean?	Archean ?	Ars			Archean.	Archean.

ARTESIAN SECTION SHOWING THE ROCKS WITH WHICH THE WELL-BORER IS CHIEFLY CONCERNED.

NUMBERS SHOW HEIGHTS ABOVE THE HIGHEST WATER-BEARING BED.
SCALE: 100 FEET = 1 INCH.

Formation Name.	Symbol.	Columnar Section.	Scale of Feet.	Character of Rocks.
Pierre shale.	Kp		1300	Lead-gray shale; on fresh exposures splitting into papery flakes; essentially fine-textured but often appearing rough by reason of small crystals of white selenite (gypsum) formed between the layers; traversed near the base by thin veins of gypsum; contains a few calcareous concretions.
			1200	
Niobrara formation.	Kn		1100	Calcareous shale with layers of impure limestone; gray but weathering yellow and orange; contains bones and scales of fish.
			1000	Shale; lead-gray weathering to pale-salmon color; fine-grained but often roughened by white selenite crystals; contains many fish scales and shreds of vegetal tissue.
			900	
			800	
			700	Calcareous shale; light bluish-gray weathering yellow; near the top occasional beds of chalky limestone, white or cream colored; contains fossil shells, especially a small oyster attached to fragments of a larger shell.
			600	Limestone; light bluish-gray weathering creamy white; beds 6 to 30 inches thick, separated by 1 to 3 inches of shale; contains fossil shells, especially a bivalve (Inoceramus) 4 to 10 inches in diameter.
Carlile shale.	Kcr		500	Yellow sandstone. Yellow, green, and gray sandy shale, with local beds of sandstone; contains globular concretions, 1 to 5 feet in diameter, cracked within and more or less filled with crystals of calcite. Dark-gray shale. Medium-gray shale; local thin layers of white clay; also local thin limestones composed of oysters.
Greenhorn limestone.	Kgn		400	Pale-blue limestone in beds 3 to 12 inches thick separated by shale beds 10 to 20 inches thick; contains fossil shells, especially a thin oval form 4 to 10 inches long (Inoceramus).
Graneros shale.	Kgs		300	Medium-gray shale. Impure brown limestone, 2 inches thick, with oysters and other fossils. Dark-gray shale.
			200	Dark-gray and medium-gray shale; local thin beds of white clay; also locally a zone of dark, heavy concretions, 1 to 3 feet across.
Dakota sandstone.	Kd		100	Orange and brown sandstone, alternating with light-gray and dark-gray shale beds.
			0	HIGHEST WATER-BEARING BED.
				Sandstone; white or gray, often with orange or brown specks; firm to friable; strata 3 to 20 feet thick; usually divided by shale layers into beds 20 to 150 feet thick. The more porous beds carry water, and all artesian wells of the district obtain their water from these beds. The total thickness ranges from 250 to 600 feet.

G. K. GILBERT,
Geologist.

SPECIAL ILLUSTRATIONS

Fig. 17.

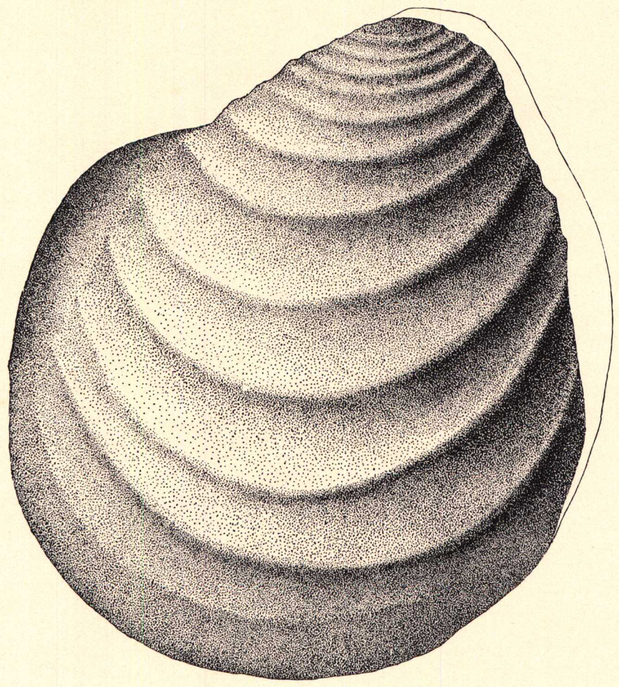
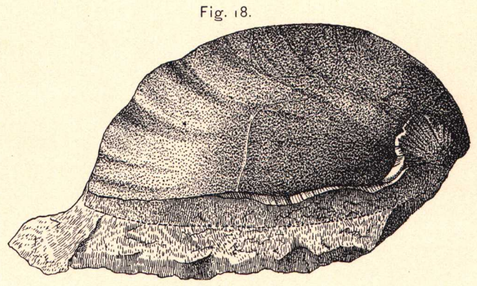


Fig. 18.



FIGS. 17, 18.—INOCERAMUS DEFORMIS.

Single valves of a bivalve shell found fossil in the limestone at the base of the Niobrara formation. Fig. 17 shows the side of a specimen of ordinary size; fig. 18 the edge of a small individual. The mud which once filled the shells was hardened to stone and the shells were afterward broken away, leaving molds of the interior.

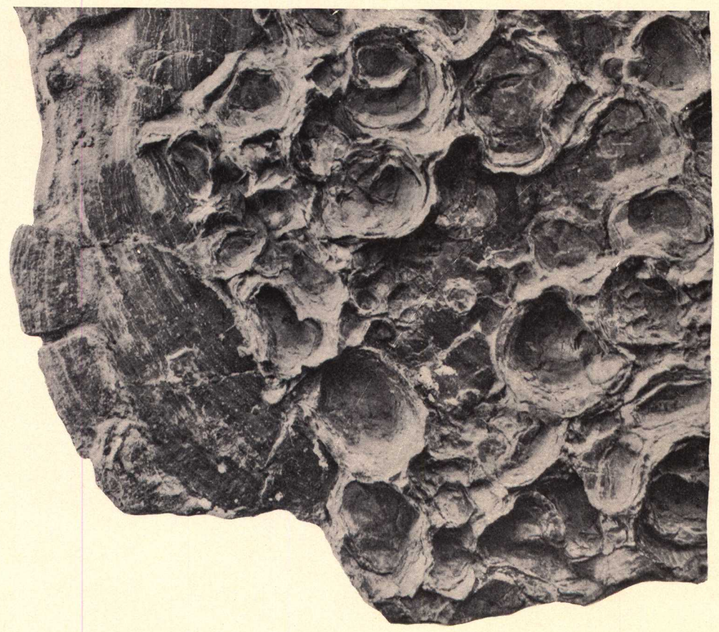


FIG. 19.—OYSTER SHELLS ATTACHED TO A LARGER SHELL (INOCERAMUS).

From a photograph; natural size.

Such groups are found in several formations, but they are peculiarly abundant in the calcareous shales near the bottom of the Niobrara.

Fig. 20.

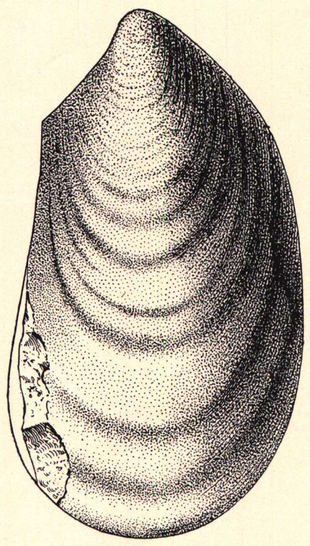
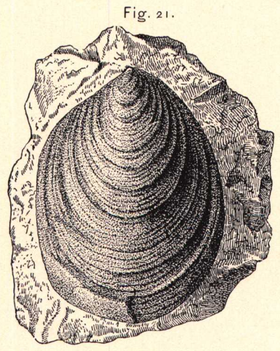


Fig. 21.



FIGS. 20, 21.—INOCERAMUS LABIATUS.

A fossil bivalve shell occurring in abundance in certain layers of the Greenhorn limestone. Fig. 20 shows an individual of moderate size; fig. 21 a small individual in which the concentric ridges are unusually strong.

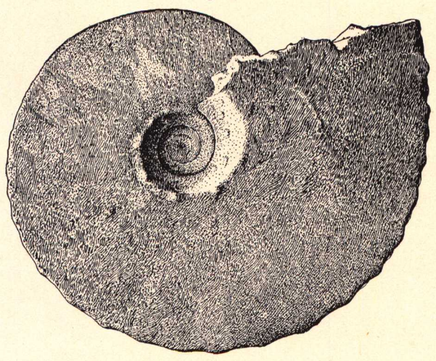
FIG. 22.—HETEROCERAS NEBRASCENSE.

From a photograph; natural size.

A fossil shell occurring in the Tepee zone of the Pierre shale and best preserved in concretions. This specimen, which includes two-thirds of the whole individual, is more nearly complete than the specimens usually found. Fragments 3 or 4 inches in length are comparatively common.

Fig. 23.

Fig. 24.



FIGS. 23, 24.—PLACENTICERAS PLACENTA.

Two views, natural size, of a small individual; specimens often have a diameter several times greater. The fossil shell is found only in the Tepee zone of the Pierre shale. Its nearest relative among living shells is the Nautilus.

FIG. 25.—THE GREENHORN LIMESTONE.

From a photograph.

A characteristic outcrop, showing the alternation of limestone ledges with softer layers of shale.

FIG. 26.—LUCINA OCCIDENTALIS.

From a photograph; natural size.

This fossil shell is a bivalve, occurring in the Tepee zone of the Pierre shale. It is abundant in the limestone cores of the Tepee buttes (fig. 27), and is the most characteristic fossil of those cores.

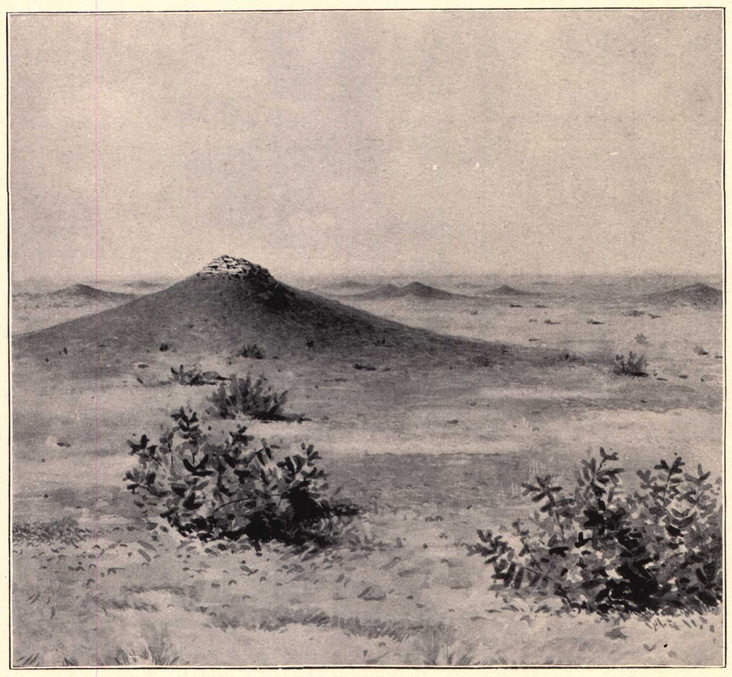


FIG. 27.—A TEPEE BUTTE.

Part of the limestone core is seen in the crest. These buttes are characteristic of the Tepee zone of the Pierre shale.