COLUMNAR SECTION

GENERALIZED SECTION OF THE SEDIMENTARY ROCKS OF THE CENTRAL BLACK HILLS, SOUTH DAKOTA.

SCALE: 1 INCH=500 FEET.

System.	Series or Group.	Formation.	Symbol.	Section.	Thickness in Feet.	Character of Rocks.	Character of Topography and Soil.
TERTIARY	OLIGOCENE — WHITE RIVER GROUP	Brule clay and Chadron formation undifferentiated.	Tw		0–250	Sand, gravel, clay, fuller's earth, sandstone, and limestone.	Valleys and saddles among the ridges and plateaus, with badlands.
		UNCONFORMITY					
CRETACEOUS	UPPER CRETACEOUS — MONTANA GROUP	Pierre shale.	Kp		1,000–1,200	Principal horizon of limestone lenses giving rise to tepee buttes. Widely scattered limestone masses giving rise to small tepee buttes. Black fissile shale containing cone-in-cone and other concretions.	Small rocky, sharply conical hills or tepee buttes. Wide, rolling plains with shallow valleys. Clay soil, in greater part sodded.
	UPPER CRETACEOUS — COLORADO GROUP	Niobrara formation.	Kn		175–225	Impure chalky limestone or calcareous clay, containing many shells of *Ostrea congesta*.	Valleys or flat areas with fertile soil.
		Carlile shale.	Kcr		500–750	Light-gray shale containing numerous large concretions and sandy layers. Dark-gray shale.	Rolling plains and valleys. Clay soil.
		Greenhorn limestone.	Kg		50–65	Impure slabby limestone which weathers light buff and contains many shells of *Inoceramus labiatus*.	Low ridges with thin soil.
		Graneros shale.	Kgs		900–1,150	Dark-gray shale.	Wide rolling plains. Clay soil.
		(Mowry shale member.)	(Kmr)		(225–250)	Shale that weathers light gray and contains numerous fish scales. Sandstone locally at base.	Wooded ridges.
						Dark fissile shale.	Rolling plains and valleys. Clay soil.
		Dakota sandstone.	Kd		25–200	Massive sandstone, weathering brown, thinner-bedded at top. Conglomerate locally at base.	Rocky slopes and cliffs. Sandy soil.
	LOWER CRETACEOUS	Fuson shale.	Kf		30–188	Massive gray to purple shale or clay.	Slopes with clay soil, partly bare.
		OVERLAP — Minnewaste limestone.	Kmw		0–25	Massive gray limestone; present only in extreme southeastern part.	Outer slope of hogback ridges.
		Lakota sandstone.	Klk		70–485	Coarse hard cross-bedded sandstone, mostly buff to gray. Conglomerate at base.	Hogback ridges, sloping plateaus, cliffs, and canyons. Thin sandy soil.
	CRETACEOUS?	OVERLAP SOUTHWARD — Morrison shale.	Km		0–220	Greenish to maroon shale and thin limestone. Absent in southern part.	Inner slope of hogback ridges. Clay soil.
JURASSIC	UPPER JURASSIC	UNCONFORMITY — Unkpapa sandstone.	Ju		0–225	Soft massive fine-grained sandstone. Absent in western and northwestern parts.	Steep slopes, mostly covered by talus.
		Sundance formation.	Jsd		70–300	Sandstone, shale, and thin fossiliferous limestone.	Inner slopes of hogback ridges, mostly covered by talus.
TRIASSIC ?		UNCONFORMITY — Spearfish formation.	Ts		500–700	Gypsum overlain by red shale. Red sandy shale, soft red sandstone, and gypsum beds. Gypsum locally near base.	Wide valley with thin barren red soil except where covered by alluvium.
(?)	(?) PERMIAN?	Minnekahta limestone.	Cmk		30–50	Massive gray, thinly laminated limestone.	Rocky slopes and canyon walls. Thin soil.
		Opeche formation.	Co		75–115	Red shale and red slabby sandstone.	Slopes of limestone ridges, mostly covered by talus.
CARBONIFEROUS	PENNSYLVANIAN	Minnelusa sandstone.	Cml		400–600	Massive granular sandstone, slabby sandstone, and limestone of reddish, buff, and white colors. Red shale and white concretionary limestone at base.	Rocky ridges, mountain slopes, and canyon walls. Sandy soil.
	MISSISSIPPIAN	Pahasapa limestone.	Cp		300–630	Mostly massive light-colored limestone weathering dove-colored.	High ridges, plateaus, and cliffs. Thin fertile soil.
		Englewood limestone.	Ce		30–60	Pale-pink to buff slabby limestone, with shale locally at base.	Slopes, mostly covered by talus.
ORDOVICIAN	UPPER ORDOVICIAN	UNCONFORMITY — Whitewood limestone.	Ow		0–80	Massive buff limestone. Present only in northwestern part.	Cliff or bench in canyon wall.
CAMBRIAN	UPPER CAMBRIAN	UNCONFORMITY — Deadwood formation.	€d		40–500	Massive buff to brown sandstone at top locally overlain by green shale. Greenish glauconitic shale, flaggy dolomite, and flat-pebble limestone conglomerate. Sandstone and locally quartz conglomerate at base.	Wide high plateaus, ridges, slopes, and canyon walls. Sandy soil.
PRE-CAMBRIAN		UNCONFORMITY — Schist, slate, grit, granite, and other igneous rocks.				Micaceous, quartzitic, garnetiferous, calcareous, and other schists, slate, quartzite, and arkosic grit, intruded by granite, amphibolite, monzonite, and other igneous rocks in laccoliths, sills, and dikes.	High rocky ridges and valleys. Fertile soil in parts of intervening valleys.

DEPARTMENT OF THE INTERIOR
HUBERT WORK, SECRETARY
U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

ILLUSTRATIONS I

SOUTH DAKOTA
CENTRAL BLACK HILLS

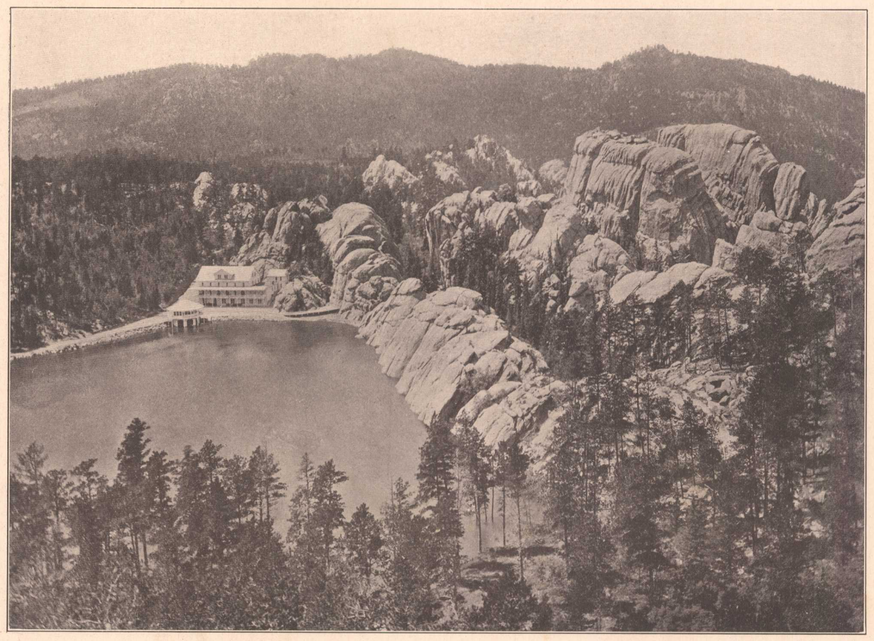

PLATE I.—CHARACTERISTIC EROSION FORMS IN MASSIVE GRANITE AT SYLVAN LAKE.
View northeastward. Harney Peak in distance.

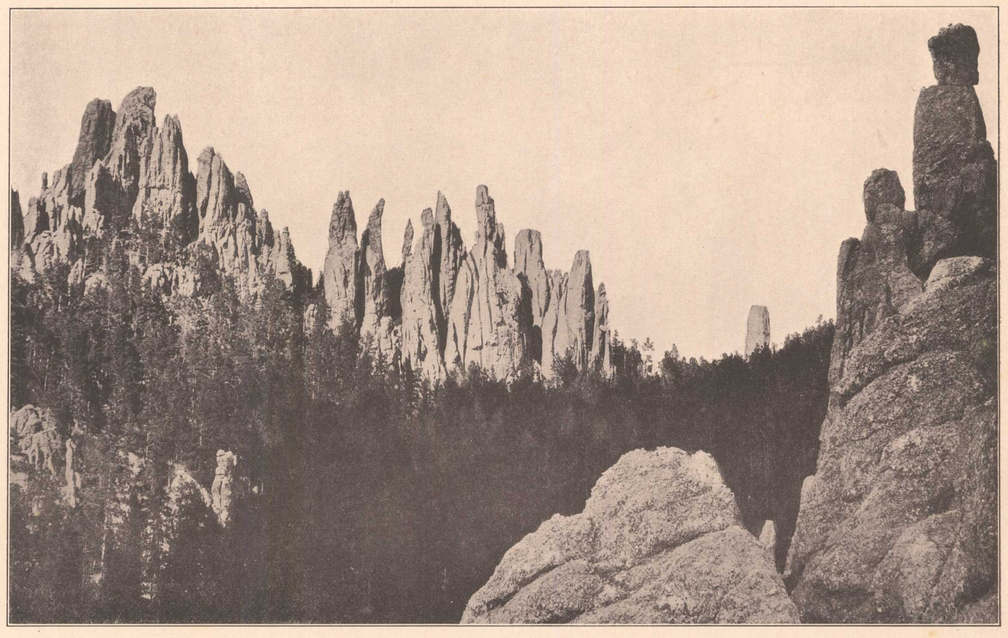

PLATE II.—THE NEEDLES: EROSION FORMS OF MASSIVE GRANITE AT SOUTH END OF HARNEY PEAK RIDGE, EAST OF SYLVAN LAKE.
View southeastward.

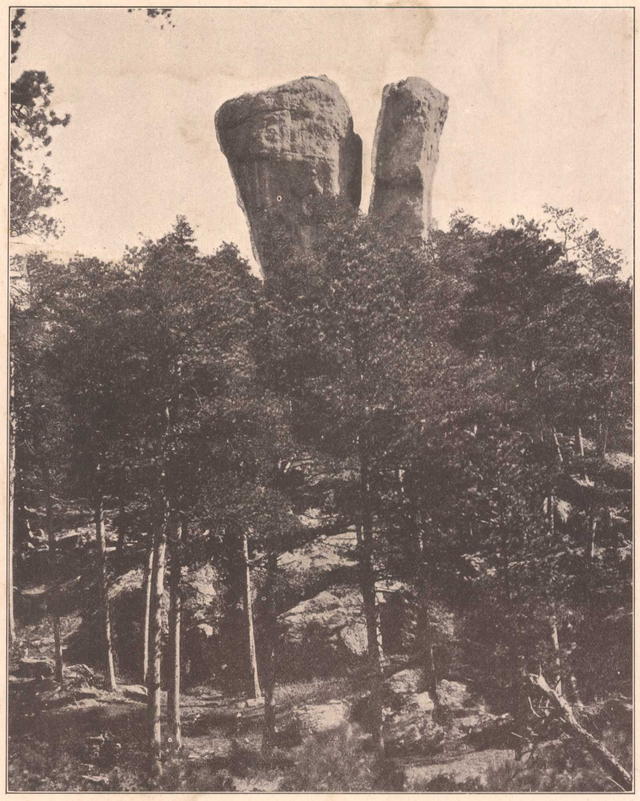

PLATE III.—BEECHER ROCKS: PINNACLED EROSION FORM OF GRANITE DIKE 6 MILES SOUTH OF CUSTER.

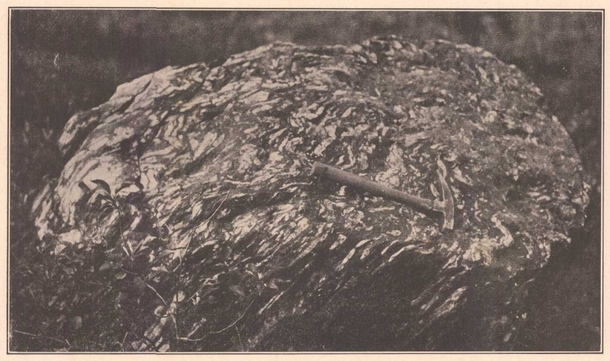

PLATE IV.—TYPICAL BRECCIATION IN OXIDIZED OUTCROP OF PROMINENT QUARTZ-PYRITE REPLACEMENT VEIN THAT EXTENDS SOUTHWARD FROM HAY CREEK.

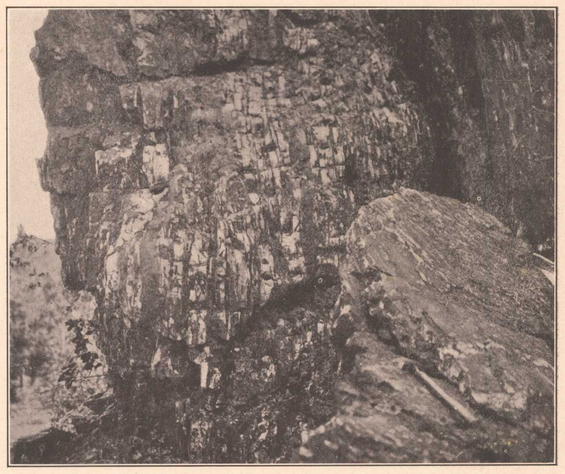

PLATE V.—BANDING OF QUARTZITE AND SLATE IN OXIDIZED WALL-LIKE OUTCROP OF QUARTZ-PYRITE REPLACEMENT VEIN THAT EXTENDS SOUTHWARD FROM HAY CREEK.

PLATE VI.—QUARTZITE-SLATE BANDING IN ALGONKIAN QUARTZITE IN OUTCROP ON ELK CREEK 1½ MILES WEST OF FORMER ELK CREEK POST OFFICE.

PLATE VII.—LARGE CRYSTALS OF SPODUMENE IN GRANITE DIKE AT ETTA MINE, NEAR KEYSTONE.

PLATE VIII.—VERY COARSE CONGLOMERATE IN ALGONKIAN ROCKS ON NORTH SIDE OF ESTES CREEK.

PLATE IX.—INTRICATE INJECTION OF GRANITE INTO ALGONKIAN SCHIST AT SOUTHERN BORDER OF HARNEY PEAK INTRUSIVE MASS.

PLATE X.—REMNANT OF MASS OF ALGONKIAN SCHIST, RECOGNIZABLE BY BANDING, NEARLY ASSIMILATED BY INVADING GRANITE IN CONTACT ZONE NORTH OF CUSTER.

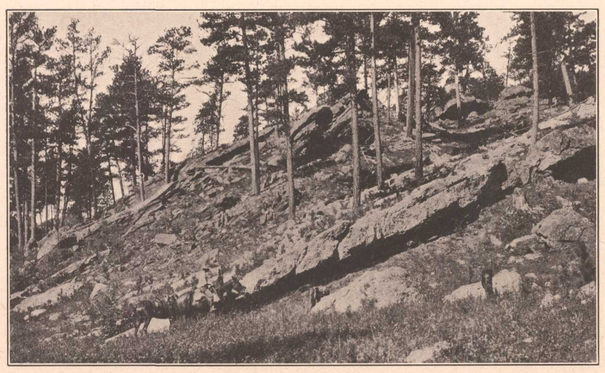

PLATE XI.—GRANITE INVADING ALGONKIAN SCHIST IN NUMEROUS PARALLEL SILLS IN BORDER ZONE OF GRANITE INTRUSION NORTHEAST OF CUSTER.

PLATE XII.—ALGONKIAN SILICEOUS SCHIST AND ARKOSIC GRIT WEATHERED INTO PINNACLES WEST OF NEMO.

ILLUSTRATIONS II

PLATE XIII.—CONGLOMERATE AT BASE OF DEADWOOD FORMATION ON ELK CREEK.
Boulders of Algonkian quartzite and schist in matrix of yellow sand.

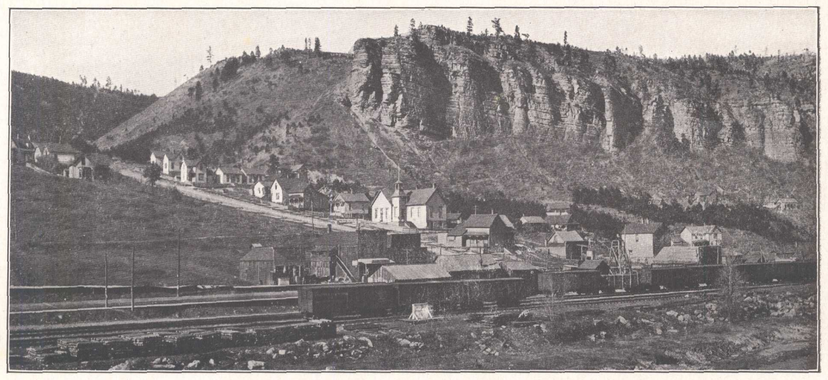

PLATE XIV.—DEADWOOD FORMATION IN NORTHERN PART OF DEADWOOD.
Thick mass of regularly bedded sandstone near top of formation. View northwestward.

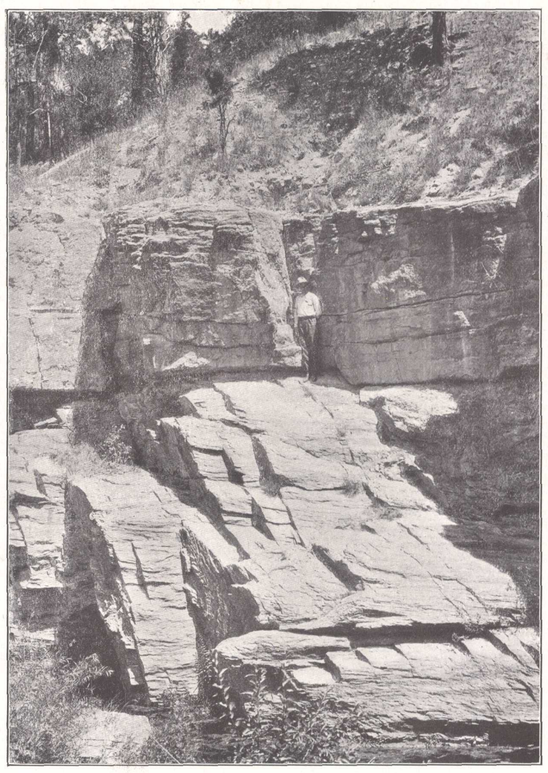

PLATE XV.—CONTACT OF NEARLY HORIZONTAL DEADWOOD FORMATION WITH UNDERLYING JOINTED ALGONKIAN SCHIST IN COLD-BROOK CANYON 4 MILES SOUTHWEST OF WIND CAVE.
The man stands at the contact. View northward.

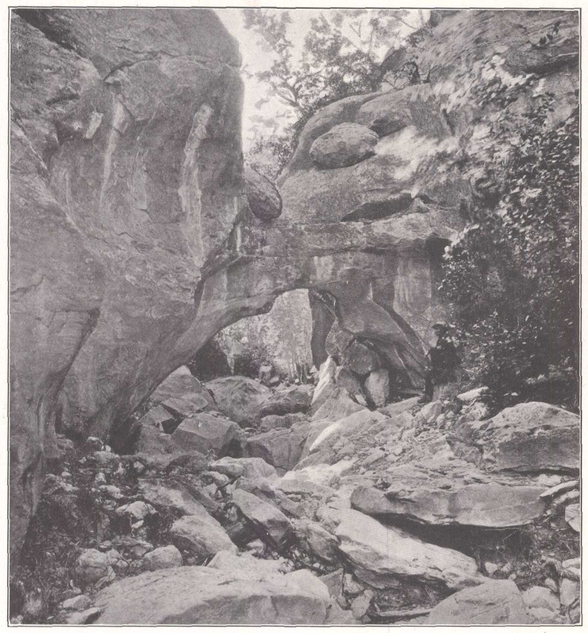

PLATE XVI.—NATURAL BRIDGE IN BANDED UNKPAPA SANDSTONE 2 MILES WEST OF BUFFALO GAP.
Shows massive structure and cross-bedding of formation.

PLATE XVII.—TYPICAL CLIFFS OF PAHASAPA LIMESTONE AT MOUTH OF HELLGATE GULCH, IN SPEARFISH CANYON 6 MILES WEST OF ENGLEWOOD.

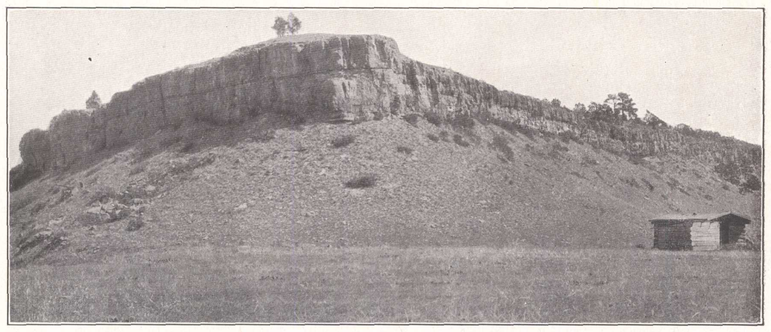

PLATE XVIII.—TYPICAL ESCARPMENT OF MINNEKAHTA LIMESTONE CAPPING HILL AND SURMOUNTING RED SHALE OF OPECHE FORMATION ON SLOPE IN GILLETTE CANYON.

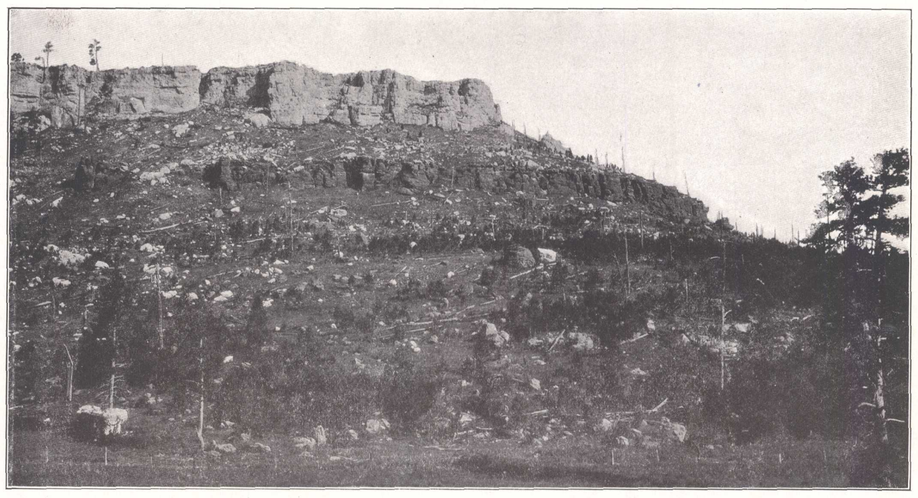

PLATE XIX.—PAHASAPA LIMESTONE CAPPING MESA AND DEADWOOD FORMATION ON STEEP SLOPES OF CANYON OF BOXELDER CREEK OPPOSITE MOUTH OF JIM CREEK.
View northward Upper dark ledge is massive purplish sandstone near top of Deadwood formation.

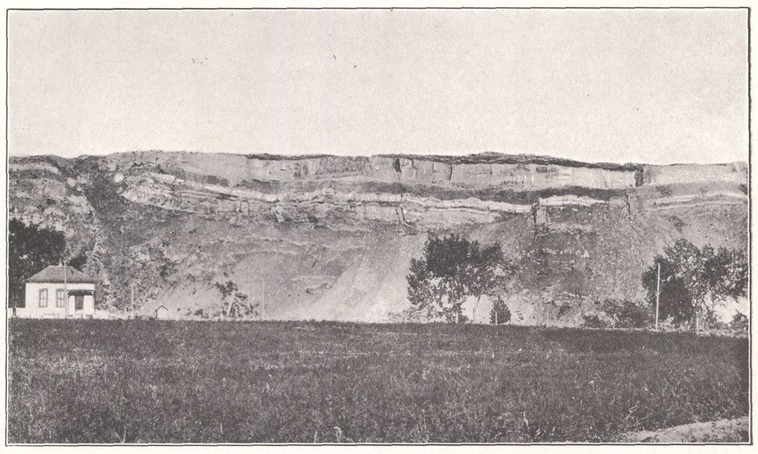

PLATE XX.—THICK BEDS OF WHITE GYPSUM IN SPEARFISH FORMATION IN EAST BANK OF COLD BROOK 1 MILE ABOVE HOT SPRINGS.

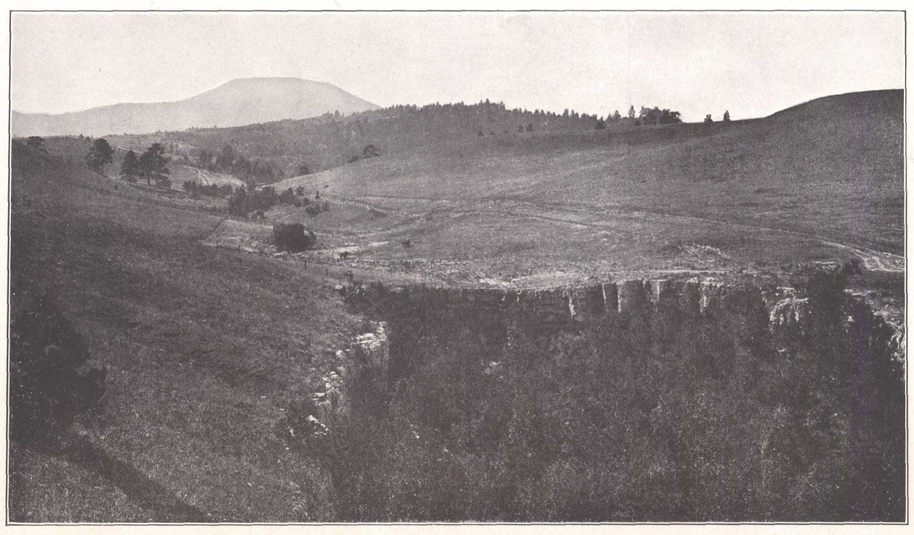

PLATE XXI.—TYPICAL GORGE IN MINNEKAHTA LIMESTONE (IN FOREGROUND) WORKING BACK INTO VALLEY OF RED SHALE OF SPEARFISH FORMATION SOUTH OF SPEARFISH.

PLATE XXII.—INCLINED BEDS OF MINNELUSA SANDSTONE DIPPING WESTWARD INTO BOULDER PARK SYNCLINE ON BEAR BUTTE CREEK 4 MILES WEST-SOUTHWEST OF STURGIS.

PLATE XXIII.—CHADRON FORMATION OF WHITE RIVER GROUP ON DIVIDE BETWEEN FRENCH CREEK AND CHEYENNE RIVER 7 MILES SOUTHEAST OF FAIRBURN.
View eastward. Underlying dark Pierre shale is exposed in ravines.

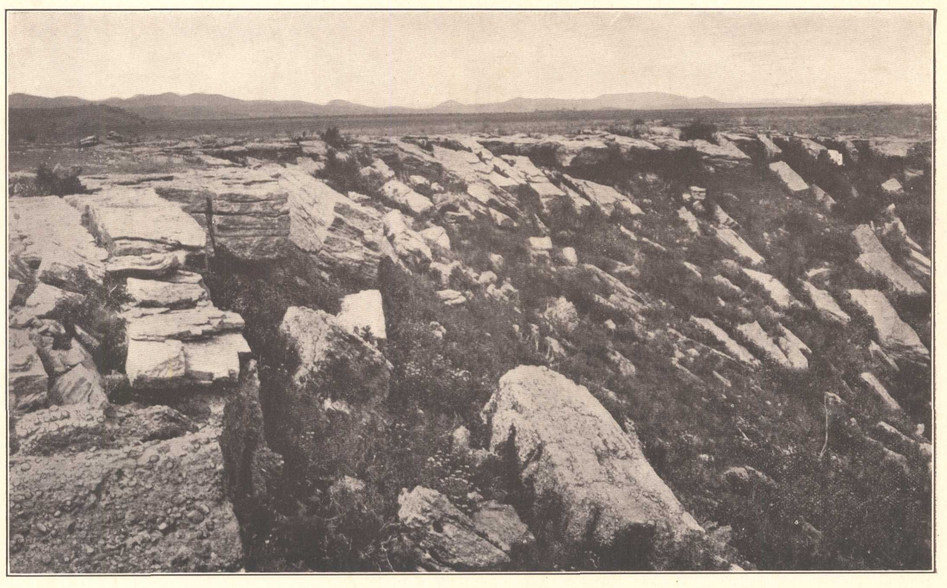

PLATE XXIV.—CONGLOMERATE OF WHITE RIVER GROUP FORMING MESA SOUTH OF RAPID CITY.
View northwestward toward slope of Hogback Ridge (in distance).

PLATE XXV.—CROSS-BEDDED CONGLOMERATE OF WHITE RIVER GROUP IN CUT OF CHICAGO & NORTHWESTERN RAILWAY 6 MILES SOUTHWEST OF FAIRBURN.

PLATE XXVI.—LIMESTONE IN WHITE RIVER GROUP IN RED VALLEY 9 MILES NORTHWEST OF HERMOSA.
View northeastward. Hogback Ridge in distance at right.

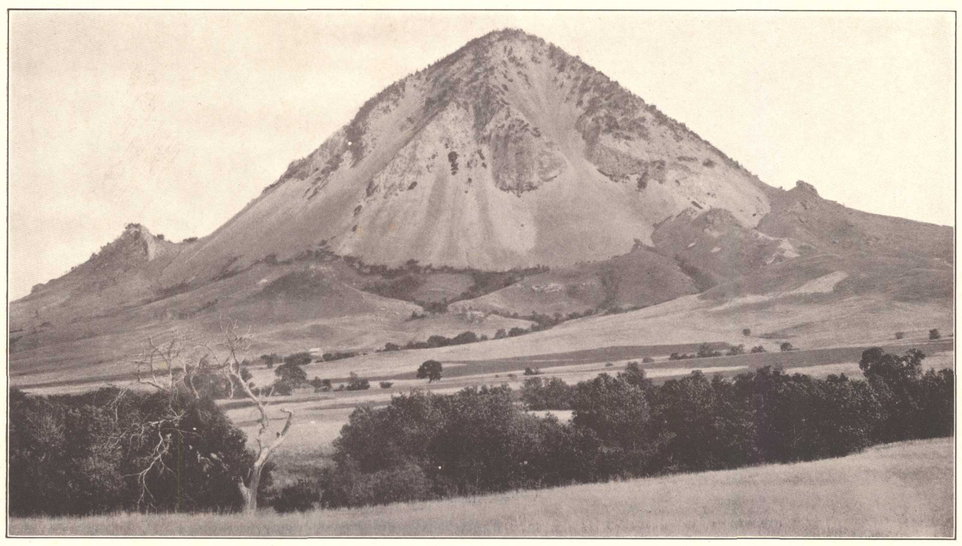

PLATE XXVII.—BEAR BUTTE AS SEEN FROM THE NORTH.
A conical laccolithic intrusive mass. Ridge of vertical Pahasapa limestone at left; knob of Minnelusa sandstone and slopes of Sundance formation at right.

PLATE XXVIII.—GREAT ARCH OF UPPER PURPLISH SANDSTONE MEMBER OF DEADWOOD FORMATION IN LOWER CLIFF AND WHITE PAHASAPA LIMESTONE IN UPPER CLIFFS IN CANYON OF LITTLE ELK CREEK, 2 MILES WEST OF PIEDMONT.
View northeastward.

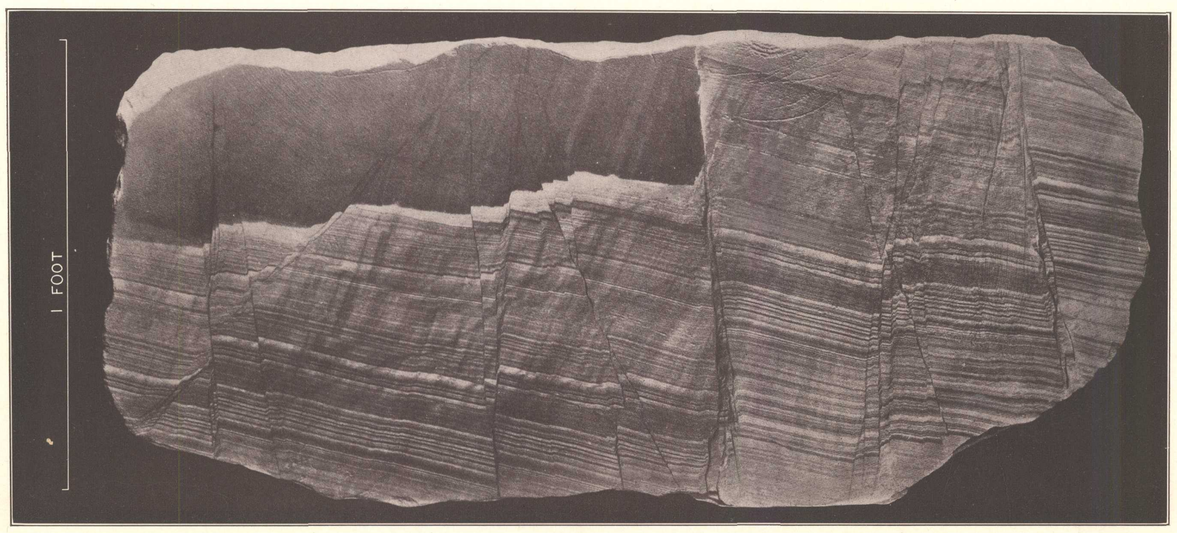

PLATE XXIX.—SAWED BLOCK OF UNKPAPA SANDSTONE FROM LOCALITY WEST OF BUFFALO GAP, SHOWING MINUTE LAMINAE OFFSET BY STEP FAULTS.

PLATE XXX.—DROP FAULT IN LAKOTA SANDSTONE IN NORTH WALL OF CANYON OF DRY CREEK 5 MILES NORTHWEST OF FAIRBURN.