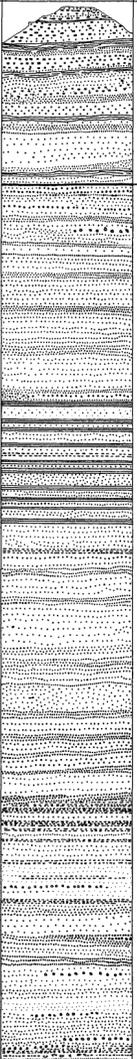
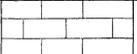
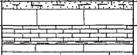


COLUMNAR SECTION.

U.S. GEOLOGICAL SURVEY.
J.W. POWELL, DIRECTOR.

MONTANA
LIVINGSTON SHEET

SECTION AT YELLOWSTONE CANYON NEAR LIVINGSTON.						
PERIOD.	FORMATION NAME.	FORMATION SYMBOL.	COLUMNAR SECTION. Scale 1000 feet = 1 inch.	THICKNESS IN FEET.	CHARACTER OF ROCKS.	CHARACTER OF TOPOGRAPHY.
<p>CRETACEOUS?</p> <p>NOTE.—The fossils of the Livingston formation do not yet afford conclusive evidence of its age. It is most nearly allied with the upper Cretaceous but is separated from the Laramie by an unconformity and a period of volcanic activity with mountain development.</p>	<p>Livingston formation (including 1400 feet of beds, probably of Fort Union age).</p>	lv		1400	<p>Light gray or yellow friable sandstone, thickly bedded and cross-bedded, alternating with gray silty shale holding intercalations of hard lamellar sandstone and lenses of blue limestone, which weather in concentric forms. Plant remains and fresh water shells occur in the strata.</p>	<p>Generally low but rough country, in which the sandstones form low combs and ridges, and the shale belts level plains.</p>
				7000	<p>Sandstone with beds of conglomerate formed of water worn pebbles six inches or less in diameter, mainly of volcanic material, but including fragments of all earlier formations.</p> <p>Alternating beds of sandstone and crumbly green or purple shale.</p> <p>Poorly assorted sandstone and grits of volcanic debris</p> <p>Local intercalations of volcanic breccias, agglomerates and tuff beds, representing volcanic eruptions.</p> <p>Dark brown or green sandstone containing plant remains with local beds of conglomerate.</p>	<p>Rough hills and broken country, generally barren and unfit for cultivation.</p> <p>Undulating country, the sandstones forming low ridges. This part of the series generally forms valleys.</p> <p>Long ridges or combs projecting above barren slopes, which are generally smooth.</p> <p>Ridges formed of the sandstone beds, the outcrops being often concealed by debris.</p>
<p>CRETACEOUS</p>	Laramie sandstone.	Kl		1000	<p>Light gray or yellow sandstone with shale beds and workable seams of coal. Plant remains with brackish water shells.</p>	<p>Bluffs or ridges rising above gentle slopes of Montana shale.</p>
	Montana shale.	Km		2900	<p>Lead gray, arenaceous shale with thin beds of sandstone. Marine fossils.</p>	<p>Foot-hill country, sandstone ledges projecting above smooth grassy slopes of shale belts.</p>
	Colorado shale.	Kc			<p>Calcareous shale with interbedded sandstone. Marine fossils.</p> <p>Black bituminous shale.</p>	
	Dakota sandstone.	Kd		600	<p>Quartzite underlain by sandy shale passing into conglomerate at the base. Fresh water fossils in limestone near the top.</p>	<p>Prominent foot-hill ridges.</p>
<p>JURATRIAS</p>	Ellis limestone.	Je		460	<p>Thinly bedded impure limestone. Marine fossils of Jurassic types.</p>	<p>Narrow valleys between mountain slopes and foot-hills.</p>
<p>CARBONIFEROUS</p>	Quadrant quartzite.	Cq		400	<p>Quartzite alternating with thin beds of limestone passing into massive limestone at the base.</p>	<p>Mountain slopes.</p>
	Madison limestone.	Cm		1500	<p>Very massive, heavily bedded, structureless limestone, generally crystalline and of a light gray color.</p> <p>Thinly bedded and fissile, dark gray limestone. Abundant marine fossils.</p>	<p>Bold craggy mountain summits.</p> <p>Mountain masses.</p>
<p>DEVONIAN</p>	Three Forks shale.	Dr		240	<p>Alternating shale and limestone containing fossils.</p>	<p>Gulches and sags.</p>
	Jefferson limestone.	Dj		200	<p>Dark colored, arenaceous limestone, passing into massive limestone at the base.</p>	<p>Bold, bluff wall.</p>
<p>CAMBRIAN</p>	Gallatin limestone.	Cg		410	<p>Alternating shale and thinly bedded limestone, resting upon massive mottled limestone, passing into limestone conglomerate at the base. Abundant fossils.</p>	<p>Steep slopes, cliffs and bluffs.</p>
	Flathead formation.	Cf		425	<p>Crumbly shale and shaly limestone with basal quartzite.</p>	<p>Depressions and low ridges.</p>

Arnold Hague, Geologist in Charge.
Geology by Walter Harvey Weed.
Surveyed in 1890-1.