CHAPTER V.

ENUMERATION AND SEQUENCE OF FORMATIONS IN TENNESSEE.

FORMATIONS NUMBERED AND TABULATED—COMPARATIVE TOPOGRAPHICAL AND STRUCTURAL IMPORTANCE—THE COMPLETE SERIES ESTABLISHED BY GEOLOGISTS—UNABRIDGED TABLE OF TENNESSEE FORMATIONS.

369. *The Formations Numbered and Concisely Tabulated.*—The rocks of Tennessee are, in this Report, grouped into *Thirteen Principal Formations.* (§ 318.) Most of these are natural, and may be considered as established; others are provisional, and may be changed. A number of them include *minor groups* of more or less importance, and to these, also, as as matter of convenience, the name *Formation* will sometimes be applied. The main groups, commencing with the lowest in the series, are numbered consecutively, from 1 to 13; and their subdivisions are designated by adding letters to these numbers.

On this and the next page, is a table giving the names of the formations, and the order in which they occur. It is to be read from the bottom, upward, 1 being the lowest formation and 13 the topmost.

ABRIDGED TABLE OF TENNESSEE FORMATIONS.

13.	**Alluvium,** - - -	(*Most recent and topmost.*)	
12.	**Bluff Group,** - - - -	POST TERTIARY.	
	12, *b.* BLUFF LOAM, - -	"	"
	12, *a.* BLUFF GRAVEL, - -	"	"
11.	**Tertiary Group,** - - -	TERTIARY.	
	11, *c.* BLUFF LIGNITE, (*provisional,*)	"	" ?
	11, *b.* ORANGE SAND, (or *La Grange Group,*) - -	"	"
	11, *a.* PORTER'S CREEK GROUP, (*provisional,*) - -	"	" ?

10.	**Cretaceous,**		CRETACEOUS.
	10, *c.* RIPLEY GROUP, (*provisional,*)		"
	10, *b.* GREEN SAND, (*Shell bed,*)		"
	10, *a.* COFFEE SAND,		"
9.	**Coal Measures,**		CARBONIFEROUS.
8.	**Lower Carboniferous,**		"
	8, *b.* MOUNTAIN LIMESTONE,		"
	8, *a.* SILICEOUS,		"
7.	**Black Shale,**		DEVONIAN.
6.	**Lower Helderberg,**		UPPER SILURIAN.
5.	**Niagara,**	"	"
	5, *d.* MENISCUS LIMESTONE, (*Sneedville Limestone,*)	"	"
	5, *c.* DYESTONE GROUP,	"	"
	5, *b.* WHITE OAK MT. SANDSTONES,	"	"
	5, *a.* CLINCH MT. SANDSTONE, (*Medina,*)	"	"
4.	**Nashville,** or **Nash,**		LOWER SILURIAN.
3.	**Trenton,** or **Lebanon,**	"	"
2.	**Potsdam,**	"	"
	2, *c.* KNOX, or KNOXVILLE,	"	"
	2, *c'''.* KNOX DOLOMITE,	"	"
	2, *c''.* KNOX SHALE,	"	"
	2, *c'.* KNOX SANDSTONE,	"	"
	2, *b.* CHILHOWEE SANDSTONE, (*Potsdam proper,*)	"	"
	2, *a.* OCOEE GROUP, (*Eozoic,*)	"	"
1.	**Metamorphic,** (*Eozoic.*) (*Oldest and Lowest,*)	"	"

370. *Comparative Topographical and Structural Importance of the Formations.*—It must not be inferred that groups of the same rank in the table, are of equal importance in their relations to the topography and rocky structure of the State. This is far from being the case. Several of them have very little importance of this kind. The *Black Shale,* for instance, though a wide-spreading formation, and, in other respects, one full of interest, contributes little to the topography, or to the rocky mass of the State. Again, any one, even of the subgroups 2, *a,* 2, b and 2, *c,* has more topographical importance than have the groups 5, *d,* (excluding *5a,)* 6 and 7 together. The in-

terest attached to the formations in making up the surface of the State, or as elements in its structure, is, in a measure, proportionate to their respective thicknesses. There are, however, other characters to be considered, as, for instance, hardness and durability.

371. In thickness, as will be seen further on, the leading formations differ much. While the Potsdam (2) is many thousand feet thick, most of the others are not as many hundred, and some of them do not reach one hundred. It is to be remarked, however, that several of those, which, in Tennessee, are thin, increase in thickness when traced into other States.

372. *The Thinning out of Formations in Tennessee*.—The formations occurring in the States of New York and Pennsylvania, present quite a complete series, which is often referred to as a standard, by American geologists. Several of the numbers of this series, though very thick in the States mentioned, grow thinner when traced southward, and finally, thin out, and disappear before reaching Tennessee. Others, extending further south or southwest, have their *feather edges* in Tennessee; as, for instance, the *Lower Helderberg*, and, to a certain extent, the *Black Shale*, as well as the sub-group of the Niagara—the *Clinch Mountain Sandstone*. The Tennessee series is, therefore, less complete than the northern. Not only are some of the formations wholly absent, but others are reduced to very thin beds.

373. But further: certain Alabama and Mississippi formations run out in Tennessee, as well as some of the northern ones. This is true of the sub-groups of the *Cretaceous*, which, in the States mentioned, are very heavy, but in Tennessee, thin out and disappear.

This absence and thinning out of formations, is one of the geological peculiarities of Tennessee.

374. *The Complete Series of Formations as established by Geologists*.—In order to be able to compare the Tennessee series with the general one made out by geologists, I give the latter as found in Dr. Dana's most excellent Text-Book, and what the author says in explanation.

But first, the reader must bear in mind that the strata were formed in succession, and that each stratum, more or less loaded

with organic remains, is part of a record of the changes, both physical and organic, that were going on during a certain portion of past time. (§§ 327 to 329, inclusive.) The strata are thus the leaves of a great book, in which may be read the *history* of changes in the oceans and lands, in the atmosphere and climate, in plants and animals; the history, in a word, of the earth's physical and organic progress. The formations may be regarded as chapters in the history, each containing the record of a period, or part of a period. By careful study of the whole series of formations, especially with reference to organic remains, it is found that the history is divided into several distinct *parts,* (groups of formations,) each the record of a great *age,* embracing several periods. Corresponding to these parts, we have as many ages. In Dana's own words, the following have been ascertained: *

"(1.) There was, *first,* an age, or division of time, when there was *no life* on the globe; or, if any existed, this was true only in the latter part of the age, and the life was probably of the very simplest kind.

(2.) There was next an age, when *Shells, Mollusks, Corals, Crinoids* and *Trilobites,* abounded in the oceans, when the continents were almost all beneath the salt waters, and when there was, as far as has been ascertained, *no* terrestrial life.

(3.) There was next an age, when, besides Shells, Corals, Crinoids, Trilobites and Worms, there were *Fishes* in the waters, and when the lands, though yet small, began to be covered with vegetation.

(4.) There was next an age, when the continents were at many successive times largely dry or marshy land, and the land was densely overgrown with *trees, shrubs* and *smaller plants,* of the remains of which plants, the great coal-beds were made. In animal life, there were, besides the kinds already mentioned, various *Amphibians* and some other *Reptiles* of inferior tribes.

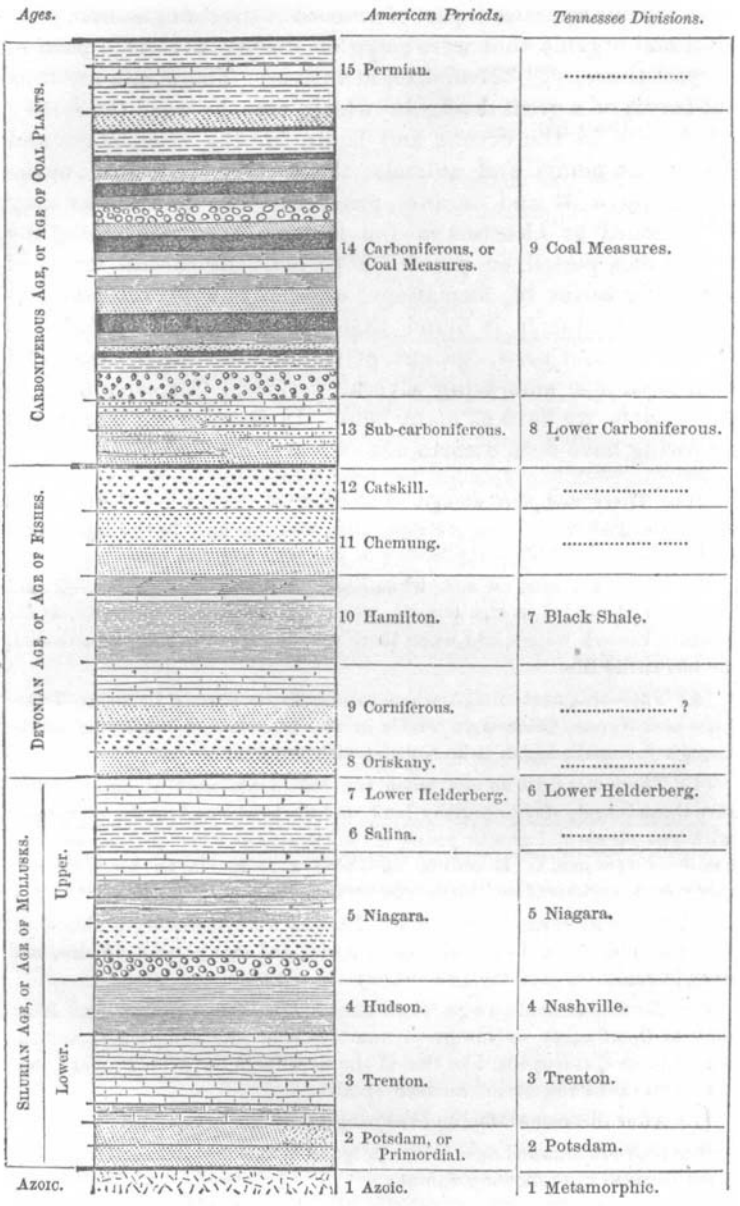
(5.) There was next an age, when *Reptiles* were exceedingly abundant, far outnumbering and exceeding in variety, and many, also, in size, and even in rank, those of the present day.

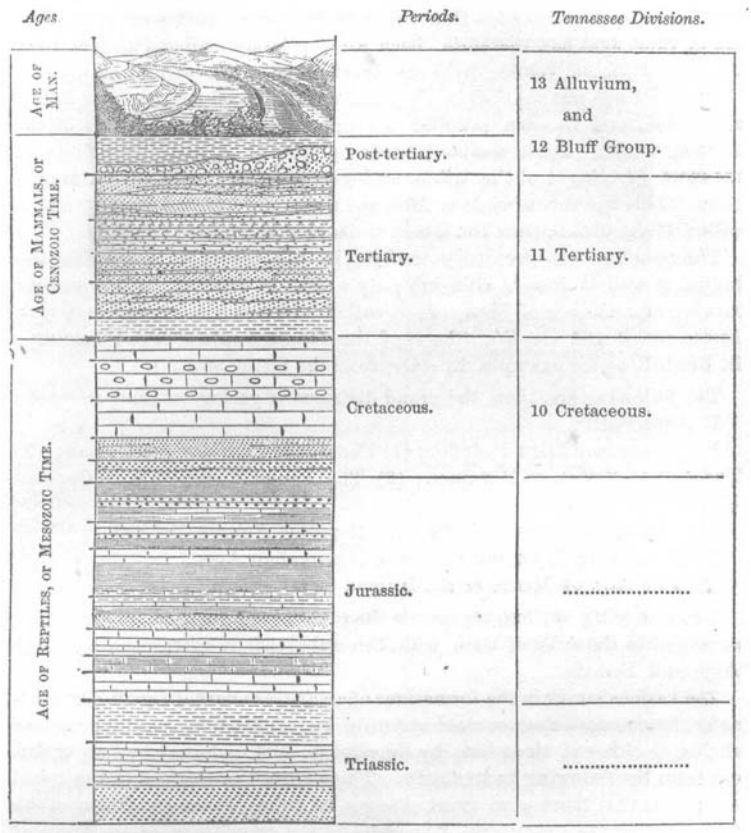
(6.) There was next an age, when the Reptiles had dwindled, and *Mammals* or *Quadrupeds* were in great numbers over the continents; and the size of these Quadrupeds, like that of the Reptiles in the preceding age, was far greater than the size of modern species.

(7.) After this came *Man,* and the progress of life here ended.

The above-mentioned ages in the progress of life and the earth's history, have received the following names:

*Text-book of Geology, pp. 63-66.


Ages.
American Periods.
Tennessee Divisions.
Carboniferous Age, or Age of Coal Plants.
Devonian Age, or Age of Fishes.
Silurian Age, or Age of Mollusks.
Upper.
Lower.
Azoic.
15 Permian.
14 Carboniferous, or Coal Measures.
13 Sub-carboniferous.
12 Catskill.
11 Chemung.
10 Hamilton.
9 Corniferous.
8 Oriskany.
7 Lower Helderberg.
6 Salina.
5 Niagara.
4 Hudson.
3 Trenton.
2 Potsdam, or Primordial.
1 Azoic.
.....
9 Coal Measures.
8 Lower Carboniferous.
.....
.....
7 Black Shale.
.....?
.....
6 Lower Helderberg.
.....
5 Niagara.
4 Nashville.
3 Trenton.
2 Potsdam.
1 Metamorphic.



NOTE.-This section is the same as that in the Text-book, with the exception of the right hand column, which has been introduced in order to show the Tennessee Divisions.

1. AZOIC TIME OR AGE.—The name is from the Greek *a, not* or *without,* and *zoe, life.*
2. AGE OF MOLLUSKS, *or* the SILURIAN AGE.
3. AGE OF FISHES, or the DEVONIAN AGE.
4. AGE OF COAL-PLANTS, or the CARBONIFEROUS AGE.
5. AGE OF REPTILES, or the REPTILIAN AGE.
6. AGE OF MAMMALS, or the MAMMALIAN AGE.
7. AGE OF MAN.

The first of these ages—the Azoic—stands apart as the preparatory time for the commencement of the systems of life. The next three ages were alike in many respects, especially in the air of antiquity pervading the tribes that then lived, the shells, crinoids, corals, fishes, coal-plants, and

reptiles belonging to tribes that are now wholly or nearly extinct. The era of these ages has, therefore, been appropriately called *Paleozoic time,* the word *Paleozoic,* coming from the Greek *palaios, ancient,* and *zoe, life.*

The next age was ushered in after the extinction of many of the Paleozoic tribes, and its own peculiar life approximated more to that of the existing world. Yet it was still made up wholly of extinct species, and the most prominent of the tribes and genera disappeared before, or at its close. This age corresponds to *Medieval* time in geological history, and is called *Mesozoic time,* from the Greek *mesos, middle,* and *zoe, life.*

The next age was decidedly modern in the aspect of its species, the higher as well as lower, although only a few of those of its later epochs survive into the age of Man. It is called *Cenozoic time,* from the Greek *kainos, recent,* and *zoe, life,* (the *ai* of the Greek words always becoming *e* in English, as, for example, in *ether,* from the Greek *aither.)*

The following are, then, the grand divisions of geological time, adopted:

I. AZOIC TIME.

II. PALEOZOIC TIME, including (1) The Age of Mollusks, or Silurian; (2) The Age of Fishes, or Devonian; (3) The Age of Coal-plants, or Carboniferous.

III. MESOZOIC TIME, including the Reptilian Age.

IV. CENOZOIC TIME, including the Mammalian Age.

V. The AGE OF MIND, or the Human Era.

The foregoing section represents the successive formations of the globe, arranged in the order of time, with the subdivisions corresponding to the Ages and Periods.

The various strata in the formations of an age, are very diversified in character, limestones being overlaid abruptly by sandstones, conglomerates or shales, or either of these last, by limestones; and each may be very different from the following in its fossils. These abrupt transitions in the strata are proofs that there were great changes, at times, in the conditions of the region where the strata were formed; and the transitions in the kinds of fossils are evidence of great destruction, at intervals, in the life of the seas. Such transitions, therefore, naturally divide off the ages into smaller portions of time, or *periods,* as they are called. By transitions similar in kind, but not so great, *periods* may often be subdivided into still smaller parts or *epochs.*

In the preceding section, Azoic is at the bottom, on the left; above it, there are the names *Silurian, Devonian,* and so on; and the names of the Periods, *Potsdam, Trenton,* etc., dividing off these Ages, on the right.

The names of the Periods in the first part of the section (those of the *Paleozoic)* are derived from the names of American rocks. The names in the other parts are mostly European, as the series of rocks it contains (those of *Mesozoic* and *Cenozoic* time) are more complete in Europe than in America.

375. The section given is Dana's, with the exception of the right hand column. In this I have introduced the names of

the leading Tennessee divisions, or formations, as given in the table on page 150. These, so far as they go, correspond to Dana's periods. It will be seen that *eight* of the spaces in the Tennessee column are blank. These are the geological horizons, which, though well developed elsewhere, are not represented in Tennessee. (§§ 372-3.)

376. It will be seen that the blank opposite the *Corniferous* period is marked doubtful. I have seen, at a few points, a *thin local limestone* containing corals, which may prove to be a member of this formation. The evidence, however, is by no means satisfactory, and, for the present, the bed is included in the formation next below.

377. *The Black Shale* is all that represents the Hamilton Period. In New York, the strata pertaining to this have a maximum thickness of 1200 feet. In Tennessee, its upper part alone is represented by the Black Shale, with a thickness rarely reaching 100 feet. In New York, this upper part is called the *Genesee Shale.*

Excepting the Hamilton, and those followed by a blank, all the remaining periods are well represented in Tennessee.

378. *Unabridged Table of Tennessee Formations.*—Below is presented an unabridged tabular view of the formations and their divisions, as found in Tennessee. It is an expansion of the Table given on page 150. Important localities are also mentioned, and, in some instances, topographical relations.

The Table begins with the lowest group, and ascends through the series.

TABULAR VIEW OF TENNESSEE FORMATIONS.

1. **Metamorphic.**

Characters.—Altered rocks—Azoic or Eozoic in part, mountain-making.

Thickness many thousand feet.

Examples.—The talcose slates, in part, of Beech Mountain and Slate Face, in Johnson County. Gneissoid rocks of Stone Mountain.

The syenitic gneiss of Roan Mountain.

The gneiss and mica slate of the Great Bald, in Washington.

The talcose slates and hornblendic beds of Ducktown.

2. **Potsdam.** LOWER SILURIAN,

Embraces three great sub-groups,

2,*a. Ocoee conglomerate and slates,*

2,*b. Chilhowee sandstone,* and

2,*c. Knox Group.*

2,*a.* OCOEE.

Char.—Semi-metamorphic, Eozoic; mountain-making.

Thickness, 10,000 feet?

Ex.—The conglomerates and slates of the Ocoee River.

Semi-talcose slates and conglomerates of Monroe County.

Conglomerate and slates of the Little Tennessee River.

Slates of the West Fork of Little Pigeon, in Sevier County.

Conglomerates and slates of the Smoky Mountain, in Sevier County.

Conglomerates and slates on the French Broad, in the eastern part of Cocke County.

Rocks of the Big Butt, in Greene County.

Conglomerate of the Laurel Gap of Iron Mountain, in Johnson County.

2,*b.* CHILHOWEE SANDSTONE.

Char.—Sandstones and sandy shales; mountain-making.

Thickness, 2000 feet. (§ 482.)

Ex.—Sandstones and sandy shales of Chilhowee Mountain, and of all the great outliers of the Unaka range, including Holston and Iron Mountains; Cherokee and Buffalo Mountains; Paint Mountain; English's Mountain; Chilhowee, Guide, and Star's Mountains, etc.

2,*c.* KNOX GROUP.

A triple Formation, in ascending order, as follows:

2,*c'. Knox Sandstone,*

2,*c''. Knox Shale,* and

2*c'''. Knox Dolomite.*

2,*c'* KNOX SANDSTONE.

Char.—Hard sandstones and shales, of different colors—strata often charged with sea-weeds.

Contains, at some points, interpolated layers of dolomite.

The sandstones make sharp-crested and "comby" ridges. (§ 105.)

Thickness, 800 to 1000 feet. (§ 516.)

Ex.—The rocks of Comby Ridge, in Hancock and Grainger

Counties; of Webbs Ridge, in Knox, and Poor Valley Ridge, in Grainger; of Beaver, Bull Run, and Pine Ridges, crossed in going from Knoxville to Clinton; of Piny Ridge, between Clinton and Walden's Ridge; of Bays Mountain forming the southeast boundary of Knox County; of the Ridge west of Rogersville, etc.

2,*c''*. KNOX SHALE.

Char.—Variegated shales, containing, occasionally, layers of blue oolitic dolomite and limestone—these, at points, fossiliferous. Valley-making.

Thickness, 1500 to 2000 feet. (§ 524.)

Ex.—The rocks of Poor Valley, in Knox County; of Hinds' Valley, west of Black Oak Ridge; of Bull Run Valley, and of Wolf Valley—the latter west of Chestnut Ridge; of Walker's Valley, in which Cleveland is located, and of Mouse Creek and Candy's Creek Valleys; of the Valleys of the two Chestna Creeks; of Carter's, and of Stanley Valley, in Hawkins; of the Valley of Richland Creek, in Grainger, etc.

2,*c'''*. KNOX DOLOMITE.

Char.—A great series of heavy-bedded dolomites and limestones, mostly the former. Lowest strata, blue oolitic, and often fossiliferous; strata next above, dark gray and granular; upper strata, light gray. Upper part contains layers of chert. Ridge-making. (§ 104.)

Thickness, 4000 feet. (§ 541.)

Ex.—The strata of Knoxville; these belong to the upper part.

The rocks of Black Oak, Copper, and Chestnut Ridges, between Knoxville and Clinch River.

The rocks of Missionary Ridge east of Chattanooga, and of many other ridges in East Tennessee.

The rocks, in part, of Tazewell, Kingston and Chattanooga; the rocks of Blountville, Jonesboro' and Greeneville; of Dandridge and Maryville; in part of Newport and Athens; of New Market, Loudon, Pikeville, Benton, etc.

The rocks of the central area of the Wells' Creek Basin, in Stewart County, Middle Tennessee, etc., etc.

3. **Trenton,** or **Lebanon.**

Char.—Blue and dove-colored limestones, thick and thin-bedded. Highly fossiliferous.

In East Tennessee, including the Nashville strata, gen-

erally valley-making; also (the upper shale part) making knobby belts.

In Middle Tennessee (with the Nashville formation) the mass out of which the Central Basin has, for the most part, been excavated.

Thickness, in East Tennessee, *including the Nashville rocks,* 2500 (?) feet.

Thickness, in Middle Tennessee, *not including Nashville,* 500 feet.

Ex.—In East Tennessee, *including Nashville rocks:* The Maclurea blue limestone of Kingsport, in Sullivan; of Strawberry Plains, of Lenoirs, etc.; the variegated marbles of Hawkins, Knox and other counties; the iron-limestone of the red knobs in Knox, Blount, Monroe, McMinn and Bradley; the shales of Lick Creek, in Greene; and of the knobby regions of Sullivan, Cocke, Sevier, etc; the rocks of a number of fine valley-ranges between the Holston and the East Tennessee and Georgia Railroad on the southeast, and the Cumberland Table-land on the northwest; the rocks, in part of Tazewell, Jacksboro', Clinton, Greeneville, Newport, Washington, Athens; those of Sevierville, Decatur, Georgetown, etc.

In Middle Tennessee, *not including the Nashville rocks:* The rocks of Lebanon, Murfreesboro', Shelbyville, Lewisburg; Campbellville, in Giles; Duck River Bluffs, at Columbia; Woodbury, in Cannon; Liberty, in Smith, etc.

4. **Nashville,** or **Nash.**

Char.—In East Tennessee, in part shales; in Middle Tennessee, mostly limestone. All fossiliferous, limestones highly so.

In East Tennessee, as above stated, *with the Trenton,* valley-making; the shale, in the southeastern part of the valley, making knobby belts.

In Middle Tennessee, *with the Trenton,* the rocks, for the most part, of the Central Basin.

Thickness, in East Tennessee, see under Trenton.

Thickness, in Middle Tennessee, 500 feet.

Ex.—For examples in East Tennessee, see under Trenton.

In Middle Tennessee, *the rocks of Nashville,* Gallatin, Hartsville, Gainesboro'; the rocks of the hills about Carthage, (the lowest rocks being Trenton;) the rocks of Fayetteville, Pulaski, Mt. Pleasant, Franklin; the upper rocks of Columbia, etc.; the hydraulic limestone of Clifton, and of other points in the western valley of the Tennessee River; the *orthis* and *cyrtodonta* beds of the Central Basin, etc.

5. **Niagara Group,**

Includes several formations, in ascending order, as follows:

5,*a. Clinch Mountain Sandstone,*
5,*b. White Oak Mountain Sandstones,*
5,*c. Dyestone Group,* and
5,*d. Meniscus Limestone.*

5,*a.* CLINCH MOUNTAIN SANDSTONE.

Char.—A sandstone, mostly white or gray, overlying red shales; confined to East Tennessee. The sandstone mountain-making.

Thickness: Shale, 400; Sandstone, 300, (?).

Ex.—The sandstones and red shale of *Clinch Mountain,* of House Mountain, of the Devil's Nose, in Hawkins, of the ridges of the Bays Mountain group north of Bull's Gap, including Chimney Top and Fodder Stack, of Powell's Mountain and of Lone Mountain, in Claiborne and Union.

5,*b.* WHITE OAK MOUNTAIN SANDSTONES.

Char.—Variegated sandstones, with some shales; rocks often, red or brown, fossiliferous, more or less equivalent to the last. Confined to East Tennessee. These sandstones often abound in crinoidal buttons.

Thic kness, 500 feet.

Ex.—Sandstones of the gaps in White Oak Mountain, and generally of the mountain itself. (In Georgia, in gap of Taylor's Ridge, at Ringgold. Taylor's Ridge and White Oak Mountain are the same range.)

5,*c.* DYESTONE GROUP.

Char.—Variegated shales, with thin, smooth sandstones at some points. An East Tennessee formation.

Contains beds of fossiliferous iron ore, called locally *dyestone.*

Thickness, from 100 to 300 feet.

Ex.—The shales and dyestone bands in the small ridges, the range of which skirts the eastern base of the Cumberland Table; the variegated shales along the eastern base of Powell's and Lone Mountains; the shales and ore in the ridge lying on the east, or southeast side, of Big Valley, in Union and Anderson Counties; the shales and ore of Half-moon Island and vicinity; of the small ridge skirting the base of Lookout Mountain, etc.

5,*d.* MENISCUS LIMESTONE.

Char.—In the western valley of the Tennessee River, fos-

siliferous limestone; gray, above; and variegated, below.

In the Central Basin, gray limestone.

The Sneedville (East Tennessee) limestone may be placed here.

Thickness: 150 feet in East Tennessee, and 200 feet in Middle Tennessee.

Ex.—For the greater part, the limestone of the glades in Perry, Decatur, Wayne and Hardin Counties; the gray limestone below the Black Shale, in Giles, and parts of Lincoln; the marble of the Big Sandy, in Henry County; the limestones below the Black Shale, at Centreville; the rocks of Savannah, in Hardin County, etc.

In East Tennessee, limestone on the southwest side of Sneedville; the bluish and light gray limestone in the valley between Powell's Mountain and Newman's Ridge. A bed of fossiliferous limestone, the age of which is not fully settled, lying along the eastern base of Lone Mountain, in Claiborne and Union Counties, may belong here.

6. **Lower Helderberg.**

Char.—Highly fossiliferous bluish limestone, with sometimes shale.

For the most part occurring in the Western Valley of the Tennessee River.

Thickness, maximum, 100 feet?

Ex.—The limestone below the Black Shale, at Linden, in Perry County, and at several other points below this, on Buffalo River; the limestone seen in the heads of the hollows about Decaturville; the bluff on Big Sandy, in Henry County, at Esq. John Williams's Mill, and other bluffs below, on the same stream; in the southern part of the State, the limestone and chert of the White Sulphur Springs, in Hardin County; the upper beds of limestone in the valleys of Indian and other creeks, etc. Portion of the limestone in the first bluff below Cumberland City, on the Cumberland River.

7. **Black Shale.**

Char.—Black bituminous shale, containing, more or less, iron pyrites, in grains and nodules. A very persistent bed.

Thickness, maximum, about 100 feet.

Ex.—In East Tennessee: The black shale, one mile west of Montvale Springs; the black shale, along the eastern base of Clinch Mountain; the black shale, of Sneedville;

that along the eastern base of Powell's Mountain; that in the ridge next east of Big Valley, in Union; that east of White Oak Mountain: the black shale in the small ridges skirting the eastern base of the Cumberland Table-land; that on each side of the Sequatchee Valley.

In Middle Tennessee: The black shale, generally high on the hills, within and around the sides of the Central Basin; the black shale, of Henry, Stewart, and of the other counties, including the Western Valley of the Tennessee.

8. **Lower Carboniferous.**

Has two divisions, as follows:

8,*a. Siliceous* below, and

8,*b. Mountain Limestone* above.

8,*a.* THE SILICEOUS, OR THE SILICEOUS. GROUP.

Char.—Limestone, often siliceous, the strata generally interstratified with layers of chert. In some regions, beds of shale occur.

The division is made to include the *Lithostrotion beds* as its upper part.

Ridge-making, in East Tennessee; plateau-making, in Middle Tennessee.

Thickness, from 300 to 550 feet.

Ex.—In East Tennessee: The sandstone and sandy shales of the ridge next west of Montvale Springs; the crinoidal chert layers on the east side of White Oak Mountain; sandstone and sandy shales of Pine Mountain, and of parts of Stone Mountain, east of Clinch Mountain, in Hawkins; siliceous shale, on the west slope of Newman's Ridge; the beds of crinoidal chert, in nearly all of the dyestone ridges between the Tennessee and Clinch Rivers, on the southeast, and the Cumberland Table-land, on the northwest; the crinoidal chert of the small skirting ridge generally seen at the base of the Table-land; the chert of the skirting ridges on each side of Lookout Mountain; the chert bed at the foot of the mountain, on the east side of Sequatchee Valley, and, in some parts, on the western side.

In Middle Tennessee: The group of rocks making the great plateaus of the *Highlands*, or *Highland Rim*, of Middle Tennessee, (see page 81,) and making, too, the crests of the slopes bounding the Central Basin, and the Western Valley, (pp. 97-101;) the cap rock of Elk Ridge, and its ramifications in the southern end of the Central

Basin, and of the highest ridges and knobs in other parts of the Basin.

On the rocks of the upper part, are the towns of Livingston, Cookville, Sparta, McMinnville, Winchester, Lawrenceburg, Charlotte, Dover, Clarksville, and Springfield.

On the rocks of the middle and lower parts, are Smithville Manchester, Tullahoma, Waynesboro', Newburg, Linden, Camden, and Lafayette.

8,*b.* MOUNTAIN LIMESTONE.

Char.—Mostly limestone; includes one bed of sandstone, and several beds of shale.

Starting below the sandstone crests, forms very generally, the slopes of the Cumberland Table-land.

Thickness, from 300 to 700 feet.

Ex.—The limestone and shales of Montvale Springs, in Blount County, (its extreme southeastern presentation.) The limestone belt next east, or southeast, of Pine Mountain, in Hawkins County.

The limestone of the ridge, commencing east, or northeast of Sneedville; that of Newman's Ridge.

The limestone of the valley range, east of White Oak Mountain.

The limestone and shales of the middle and upper portions of the steep slopes of the Cumberland Table-land on all sides.

The limestone and shales of Crab Orchard Mountain, and of Grassy Cove and vicinity.

Thc middle and upper limestones of the slopes of the Short Mountain, in Cannon County.

9. Coal Measures.

Char.—A series of sandstones, shales, and *stone-coal* interstratified.

The sandstone plateau-making, and when tilted, ridge, or mountain-making.

The series the cap-formation of the Cumberland Table-land.

Thickness, from 200 to 2500 feet.

Ex.—The flat top of the Cumberland Table-land.

The sandstones and shales forming the cap of the two Short Mountains, in Cannon County.

The sandstones and shales of the outliers in Overton and Fentress, among them, Double Top Mountain, of the latter county; Pilot Knob, near Old Monroe, etc.

The conglomerates, sandstones, and shales of the top of Lookout Mountain; of Walden's Ridge, Raccoon Mountain, etc.

The following towns are on the Coal Measures: Jamestown, in Fentress; Huntsville, in Scott; Crossville, in Cumberland; Spencer, in Van Buren; and Altamont, in Grundy.

10. **Cretaceous,**

Has been divided as below:

10,*a*. *Coffee Sand,*
10,*b*. *Green sand, or Shell bed,* and
10,*c*. *Ripley Group.*

10,*a*. COFFEE SAND.

Char.—A series made up of beds of gray and dark sands (when not weathered,) interspersed more or less, with clay seams. Contains occasionally, a bed of laminated clay.

Contains leaves, fragments of wood, etc., more or less converted into *lignite.*

A West Tennessee formation.

Thickness, 200 feet?

Ex.—The sands of the bluffs on the Tennessee River, at Coffee. Crump's and Pittsburg Landings, respectively.

Most of the stratified sand-beds in Hardin and Decatur counties.

Decaturville is in part upon the outcropping edge of this formation.

10,*b*. GREEN SAND, or SHELL BED.

Char.—A clayey sand, more or less calcareous, and containing *green grains* throughout, and mica scales. Highly fossiliferous. Also a West Tennessee formation.

Thickness, 200 to 350.

Ex.—The strata of the "Bald Hills" three miles northwest of Monterey, in McNairy County.

Exposures, two and three miles east of Purdy.

Cuts of the Memphis and Charleston Railroad, south of Purdy, near the Tennessee and Mississippi line.

The bed passed through in boring the Artesian wells of McNairy. (§ 269.)

The green sand bored through in the valley of Beech River, in Henderson County.

In general, the sand bed, which, at its outcrops, strews the surface with the large oyster-like shells, in McNairy and Henderson.

10,*c*. RIPLEY GROUP. *(Provisional.)*

Char.—Stratified sands, laminated more or less with clayey leaves.

Occasionally beds of dark slaty clay.

Contains a bed of impure limestone, and a sand bed with green grains.

Not found in the State east of Tennessee River.

Thickness, 400 or 500 feet. ?

Ex.—The stratified sands in the vicinity of Pocahontas, in Hardeman County.

The Turritella Limestone, of Muddy Creek, in Hardeman, and the bed of green sand in the same vicinity.

The strata outcropping around Purdy, in McNairy, and Lexington, in Henderson; Camden, in Benton, is at its eastern limit.

The strata of the upper part of the Big Sandy Valley.

11. Tertiary Group,

Embraces the following divisions:

11,*a. Porter's Creek Group,*
11,*b*. *Orange sand,* and
1I,*c*. *Bluff Lignite.*

11,*a*. PORTER'S CREEK GROUP. *(Provisional.)*

Char.—Sands and Laminated clays. West Tennessee.

Thickness, 200 or 300? feet.

Ex.—The laminated clays on Porter's Creek, near Middleton, in Hardeman; and on the Memphis and Charleston Railroad, for seven or eight miles west of the place mentioned.

The "Soapstone" beds in the eastern part of Hardeman, between Bolivar and Purdy.

The laminated clay-beds at Huntingdon and Paris.

11,*b*. ORANGE SAND, (or *La Grange Group.)*

Char.—Mostly made up of beds of sand, the strata often orange and yellow, sometimes red, white, etc. Presents occasionally, beds of clay, white and variegated. Middle area of West Tennessee.

Thickness, 600 feet. ?

Ex.—The sands and clays of the ravines about La Grange.

Strata of numerous cuts on the Memphis and Charleston Railroad, and on other railroads.

Strata of Somerville, Bolivar, Jackson, Brownsville, Trenton and Dresden; Huntingdon and Paris are about on the eastern limit of this group.

11,*c*. BLUFF LIGNITE. *(Provisional.)*

Char.—Laminated sands and clays, with well marked beds of Lignite.

Pertains to the middle and lower parts of the Mississippi Bluff, (§ 279,) through the State.

Thickness, 150? feet.

Ex.—Strata below the gravel: at "Old River," Randolph and Fulton—well exposed at numerous points in the Mississippi Bluff.

Laminated beds and Lignite below the gravel at Raleigh, in Shelby County, and on Coal Creek, in Lauderdale.

12. **Post Tertiary.**

Presents two formations, as follows:

12,*a. Bluff Gravel,* and

12,*b. Bluff Loam.*

12,*a.* BLUFF GRAVEL.

Char.—A persistent bed of sand and *gravel,* appearing along the face of the Mississippi Bluff, from Kentucky to Mississippi.

Thickness, from 10 to 50 feet.

Ex.—The gravel bed of the bluffs at Randolph and Fulton.

The gravel in the lower part of the Bluff at Memphis.

The gravel in the section at Raleigh.

The gravel bed in the Bluff along the east side of Reelfoot Lake, in Obion.

12,*b.* BLUFF LOAM.

Char.—A remarkable bed of light, ashen, buff-colored earth—a fine silicious loam, more or less calcareous. Caps the Mississippi Bluff at all points.

Thickness, from 30 to 100 feet.

Ex.—The city of Memphis is built upon it; seen in the cuts made about the city, as well as in the upper part of the Bluff.

The following towns are located upon it: Covington, Ripley, Dyersburg and Troy, and in addition to the county towns, Raleigh and Portersville.

13. **Alluvium.**

In this are grouped, *(provisionally,)*

13,*a. The Gravel of the Western Iron-ore Region, or simpler, the Ore-region Gravel.*

13,*b. The Gravel bordering the rivers of East Tennessee, or the Eastern Gravel.*

13,*c. The alluvial beds of the river bottoms, and especially of the Mississippi.*

13,*a.* THE ORE-REGION GRAVEL.

Char.—West of Nashville, *on the highlands* crossed in going to the Tennessee River, are often seen beds of gravel. These occupy high and low points, especially the former. This gravel is seen on both sides of the Tennessee River, and often many miles from it; it occurs, too, on the rolling lands outside of the bottoms, in the valley itself.

13,*b.* THE EASTERN GRAVEL.

Char., etc —Bordering the rivers of East Tennessee, and running back several miles from them, are almost universally beds of gravel. This gravel is often coarse, and consists of rounded pebbles—the water-worn fragments of the rocks of the mountains through which the rivers flow.

13,*c.* THE ALLUVIAL BEDS OF THE RIVERS.

All the rivers have bottoms made up of beds of sand, or clay, or both. The rivers have formed, and are forming, these beds.

The bottom of the Mississippi is a great area, constituting a division of the State. (§ 296.)

Beds of gravel, too, belong to this alluvial group. The sand-bars of the rivers show much gravel, fine and coarse.

On the next page is a table exhibiting at one view, the probable equivalents of the older, or paleozoic rocks, as named and described in different countries and States. It will be useful for reference. This table has been taken from the Report on the Geology of Canada, for 1863. The Tennessee column has been changed so as to agree with the classification adopted in the work.

TABLE OF THE PROBABLE EQUIVALENTS AMONG THE PALEOZOIC ROCKS OF GREAT BRITAIN AND NORTH AMERICA.

	I. Great Britain.	II. Western Canada.	III. Eastern Canada.	IV. New York.	V. Pennsylvania.		VI. Tennessee.
Carboniferous.	Carboniferous series.	.....	.....	.....	XIII. XII. XI. X.	Seral. Umbral. Vespertine.	IX. Coal Measures. VIIIb. Mountain limestone. VIIIa. Siliceous.
Devonian.	Upper Devonian.	..... Chemung and Portage group. Hamilton formation.	Gaspe sandstones, and Famine River limestones.	Catskill group. Chemung group. Portage group. Genesee slates. Hamilton group. Upper Helderberg group. Onondaga and Corniferous limestones. Schoharie grit. Cauda-galli grit. Oriskany sandstone.	IX. VIII. VII.	Ponent. Vergent. Cadent. Post merid'nal. Meridional.	VII. Black shale. .....?
	Middle Devonian.	Corniferous formation.					
	Lower Devonian.	Oriskany formation.					
Upper Silurian.	Ludlow Group.	..... Water limestone. Onondaga formation.	Limestones of Gaspe and the Bay of Chaleurs.	Lower Helderberg gr. Upper Pantamerus, Encrinal, Delthyris, Pentamerus, and Tentaculite limestones. Water-line group. Onondaga salt group.	VI.	Pre-merid'nal. Scalent.	VI. Lower Helderberg.
Middle Silurian.	Wenlock limestones. Upper Llandovery rocks. Lower Llandovery rocks.	Guelph formation. Anticosti group. Niagara formation. Clinton formation. Medina formation.	Limestones of the Chatte River.	..... Niagara limestone. Clinton group. Medina sandstone. Oneida conglomerate.	V. IV.	Surgent. Levant.	V. Niagara.
Lower Silurian.	Caradoc or Bala Group.	Hudson River gr. Hudson River formation, and Utica formation. Trenton group. Trenton formation. Black River and Birdseye formation.	..... Hudson River and Trenton groups probably wanting.	Hudson River gr. H'ds'n Riv'r shales, or Loraine shales. Utica Slate. Trenton. Black River, and Birdseye limestones.	III. II.	Matinal. Auroral.	IV. Nashville. III. Trenton.
	Upper Llandeilo rocks. Lower Llandeilo rocks. Lingula flags.	Chazy formation. Calciferous formation. Potsdam sandstone.	Quebec Group. Potsdam group.	Chazy limestone. Calciferous sandstone. Potsdam sandstone.	I.	Primal.	II. Potsdam.