DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

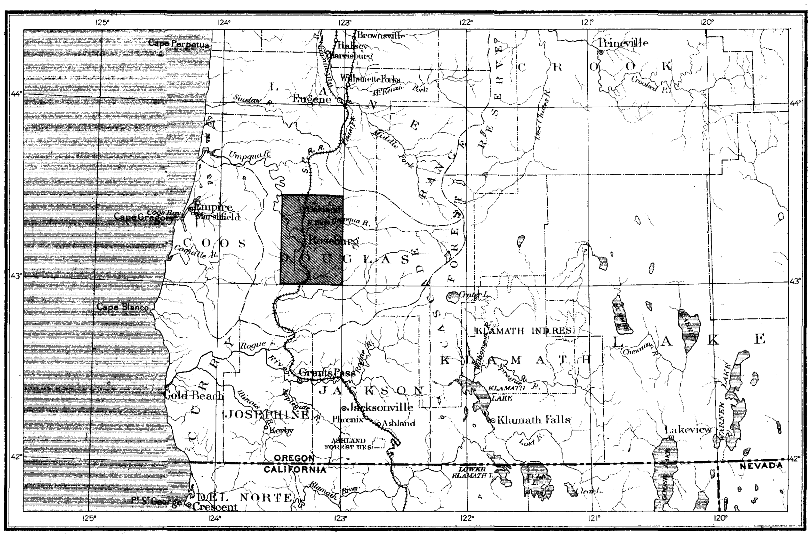
CHARLES D. WALCOTT, DIRECTOR

GEOLOGIC ATLAS OF THE UNITED STATES

ROSEBURG FOLIO

OREGON

INDEX MAP



SCALE: 40 MILES = 1 INCH

AREA OF THE ROSEBURG FOLIO

LIST OF SHEETS

DESCRIPTION | TOPOGRAPHY | HISTORICAL GEOLOGY | ECONOMIC GEOLOGY | STRUCTURE SECTIONS

SPECIAL ILLUSTRATIONS

FOLIO 49 | LIBRARY EDITION | ROSEBURG

WASHINGTON, D. C.

ENGRAVED AND PRINTED BY THE U. S. GEOLOGICAL SURVEY

BAILEY WILLIS, EDITOR OF GEOLOGIC MAPS S. J. KÜBEL, CHIEF ENGRAVER

1898

EXPLANATION.

The Geological Survey is making a geologic map of the United States, which necessitates the preparation of a topographic base map. The two are being issued together in the form of an atlas, the parts of which are called folios. Each folio consists of a topographic base map and geologic maps of a small area of country, together with explanatory and descriptive texts.

THE TOPOGRAPHIC MAP.

The features represented on the topographic map are of three distinct kinds: (1) inequalities of surface, called *relief*, as plains, plateaus, valleys, hills, and mountains; (2) distribution of water, called *drainage*, as streams, lakes, and swamps; (3) the works of man, called *culture*, as roads, railroads, boundaries, villages, and cities.

Relief.—All elevations are measured from mean sea-level. The heights of many points are accurately determined, and those which are most important are given on the map in figures. It is desirable, however, to give the elevation of all parts of the area mapped, to delineate the horizontal outline, or contour, of all slopes, and to indicate their grade or degree of steepness. This is done by lines connecting points of equal elevation above mean sea-level, the lines being drawn at regular vertical intervals. These lines are called *contours*, and the uniform vertical space between each two contours is called the *contour interval*. Contours and elevations are printed in brown.

The manner in which contours express elevation, form, and grade is shown in the following sketch and corresponding contour map:

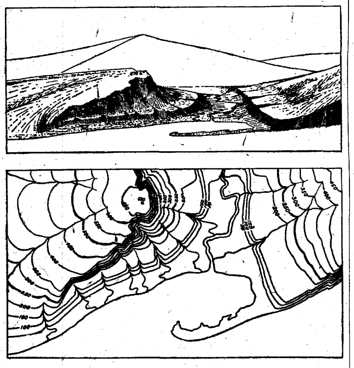


Fig. 1.—Ideal sketch and corresponding contour map.

The sketch represents a river valley between two hills. In the foreground is the sea, with a bay which is partly closed by a hooked sand-bar. On each side of the valley is a terrace. From the terrace on the right a hill rises gradually, while from that on the left the ground ascends steeply in a precipice. Contrasted with this precipice is the gentle descent of the left-hand slope. In the map each of these features is indicated, directly beneath its position in the sketch, by contours. The following explanation may make clearer the manner in which contours delineate elevation, form, and grade:

1. A contour indicates approximately a certain height above sea-level. In this illustration the contour interval is 50 feet; therefore the contours are drawn at 50, 100, 150, 200 feet, and so on, above sea-level. Along the contour at 250 feet lie all points of the surface 250 feet above sea; and similarly with any other contour. In the space between any two contours are found all elevations above the lower and below the higher contour. Thus the contour at 150 feet falls just below the edge of the terrace, while that at 200 feet lies above the terrace; therefore all points on the terrace are shown to be more than 150 but less than 200 feet above sea. The summit of the higher hill is stated to be 670 feet above sea; accordingly the contour at 650 feet surrounds it. In this illustration nearly all the contours are numbered. Where this is not possible, certain contours—say every fifth one—are accentuated and numbered; the heights of others may then be ascertained by counting up or down from a

2. Contours define the forms of slopes. Since contours are continuous horizontal lines conforming to the surface of the ground, they wind smoothly about smooth surfaces, recede into all reentrant angles of ravines, and project in passing about prominences. The relations of contour curves and angles to forms of the landscape can be traced in the map and sketch.

3. Contours show the approximate grade of any slope. The vertical space between two contours is the same, whether they lie along a cliff or on a gentle slope; but to rise a given height on a gentle slope one must go farther than on a steep slope, and therefore contours are far apart on gentle slopes and near together on steep ones.

For a flat or gently undulating country a small contour interval is used; for a steep or mountainous country a large interval is necessary. The smallest interval used on the atlas sheets of the Geological Survey is 5 feet. This is used for regions like the Mississippi delta and the Dismal Swamp. In mapping great mountain masses, like those in Colorado, the interval may be 250 feet. For intermediate relief contour intervals of 10, 20, 25, 50, and 100 feet are used.

Drainage.—Watercourses are indicated by blue lines. If the stream flows the year round the line is drawn unbroken, but if the channel is dry a part of the year the line is broken or dotted. Where a stream sinks and reappears at the surface, the supposed underground course is shown by a broken blue line. Lakes, marshes, and other bodies of water are also shown in blue, by appropriate conventional signs.

Culture.—The works of man, such as roads, railroads, and towns, together with boundaries of townships, counties, and States, and artificial details, are printed in black.

Scales.—The area of the United States (excluding Alaska) is about 3,025,000 square miles. On a map with the scale of 1 mile to the inch this would cover 3,025,000 square inches, and to accommodate it the paper dimensions would need to be about 240 by 180 feet. Each square mile of ground surface would be represented by a square inch of map surface, and one linear mile on the ground would be represented by a linear inch on the map. This relation between distance in nature and corresponding distance on the map is called the scale of the map. In this case it is "1 mile to an inch." The scale may be expressed also by a fraction, of which the numerator is a length on the map and the denominator the corresponding length in nature expressed in the same unit. Thus, as there are 63,360 inches in a mile, the scale "1 mile to an inch" is expressed by $\frac{1}{63,360}$. Both of these methods are used on the maps of the Geological Survey.

Three scales are used on the atlas sheets of the Geological Survey; the smallest is $\frac{1}{250,000}$, the intermediate $\frac{1}{125,000}$, and the largest $\frac{1}{62,500}$. These correspond approximately to 4 miles, 2 miles, and 1 mile on the ground to an inch on the map. On the scale $\frac{1}{62,500}$ a square inch of map surface represents and corresponds nearly to 1 square mile; on the scale $\frac{1}{125,000}$, to about 4 square miles; and on the scale $\frac{1}{250,000}$, to about 16 square miles. At the bottom of each atlas sheet the scale is expressed in three different ways, one being a graduated line representing miles and parts of miles in English inches, another indicating distance in the metric system, and a third giving the fractional scale.

Atlas sheets and quadrangles.—The map is being published in atlas sheets of convenient size, which are bounded by parallels and meridians. The corresponding four-cornered portions of territory are called *quadrangles*. Each sheet on the scale of $\frac{1}{250,000}$ contains one square degree, i. e., a degree of latitude by a degree of longitude; each sheet on the scale of $\frac{1}{125,000}$ contains one-quarter of a square degree; each sheet on the scale of $\frac{1}{62,500}$ contains one-sixteenth of a square degree. The areas of the corresponding quadrangles are about 4000, 1000, and 250 square miles, respectively.

The atlas sheets, being only parts of one map of the United States, are laid out without regard to the boundary lines of the States, counties, or townships. To each sheet, and to the quadrangle it town or natural feature within its limits, and at the sides and corners of each sheet the names of adjacent sheets, if published, are printed.

Uses of the topographic sheet.—Within the limits of scale the topographic sheet is an accurate and characteristic delineation of the relief, drainage, and culture of the district represented. Viewing the landscape, map in hand, every characteristic feature of sufficient magnitude should be recognizable. It should guide the traveler; serve the investor or owner who desires to ascertain the position and surroundings of property to be bought or sold; save the engineer preliminary surveys in locating roads, railways, and irrigation ditches; provide educational material for schools and homes; and serve many of the purposes of a map for local reference.

THE GEOLOGIC MAP.

The maps representing areal geology show by colors and conventional signs, on the topographic base map, the distribution of rock formations on the surface of the earth, and the structure-section map shows their underground relations, as far as known, and in such detail as the scale permits.

KINDS OF ROCKS.

Rocks are of many kinds. The original crust of the earth was probably composed of *igneous rocks*, and all other rocks have been derived from them in one way or another.

Atmospheric agencies gradually break up igneous rocks, forming superficial, or *surficial*, deposits of clay, sand, and gravel. Deposits of this class have been formed on land surfaces since the earliest geologic time. Through the transporting agencies of streams the surficial materials of all ages and origins are carried to the sea, where, along with material derived from the land by the action of the waves on the coast, they form *sedimentary rocks*. These are usually hardened into conglomerate, sandstone, shale, and limestone, but they may remain unconsolidated and still be called "rocks" by the geologist, though popularly known as gravel, sand, and clay.

From time to time in geologic history igneous and sedimentary rocks have been deeply buried, consolidated, and raised again above the surface of the water. In these processes, through the agencies of pressure, movement, and chemical action, they are often greatly altered, and in this condition they are called *metamorphic rocks*.

Igneous rocks.—These are rocks which have cooled and consolidated from a liquid state. As has been explained, sedimentary rocks were deposited on the original igneous rocks. Through the igneous and sedimentary rocks of all ages molten material has from time to time been forced upward to or near the surface, and there consolidated. When the channels or vents into which this molten material is forced do not reach the surface, it either consolidates in cracks or fissures crossing the bedding planes, thus forming dikes, or else spreads out between the strata in large bodies, called sills or laccoliths. Such rocks are called *intrusive*. Within their rock enclosures they cool slowly, and hence are generally of crystalline texture. When the channels reach the surface the lavas often flow out and build up volcanoes. These lavas cool rapidly in the air, acquiring a glassy or, more often, a partially crystalline condition. They are usually more or less porous. The igneous rocks thus formed upon the surface are called *extrusive*. Explosive action often accompanies volcanic eruptions, causing ejections of dust or ash and larger fragments. These materials when consolidated constitute breccias, agglomerates, and tuffs. The ash when carried into lakes or seas may become stratified, so as to have the structure of sedimentary rocks.

The age of an igneous rock is often difficult or impossible to determine. When it cuts across a sedimentary rock, it is younger than that rock, and when a sedimentary rock is deposited over it, the igneous rock is the older.

Under the influence of dynamic and chemical forces an igneous rock may be metamorphosed. The alteration may involve only a rearrangement of its minute particles or it may be accompanied by a change in chemical and mineralogic composi- changed by the development of planes of division, so that it splits in one direction more easily than in others. Thus a granite may pass into a gneiss, and from that into a mica-schist.

Sedimentary rocks.—These comprise all rocks which have been deposited under water, whether in sea, lake, or stream. They form a very large part of the dry land.

When the materials of which sedimentary rocks are composed are carried as solid particles by water and deposited as gravel, sand, or mud, the deposit is called a mechanical sediment. These may become hardened into conglomerate, sandstone, or shale. When the material is carried in solution by the water and is deposited without the aid of life, it is called a chemical sediment; if deposited with the aid of life, it is called an organic sediment. The more important rocks formed from chemical and organic deposits are limestone, chert, gypsum, salt, iron ore, peat, lignite, and coal. Any one of the above sedimentary deposits may be separately formed, or the different materials may be intermingled in many ways, producing a great variety of rocks.

Sedimentary rocks are usually made up of layers or beds which can be easily separated. These layers are called *strata*. Rocks deposited in successive layers are said to be stratified.

The surface of the earth is not fixed, as it seems to be; it very slowly rises or sinks over wide expanses, and as it rises or subsides the shore-lines of the ocean are changed: areas of deposition may rise above the water and become land areas, and land areas may sink below the water and become areas of deposition. If North America were gradually to sink a thousand feet the sea would flow over the Atlantic coast and the Mississippi and Ohio valleys from the Gulf of Mexico to the Great Lakes; the Appalachian Mountains would become an archipelago, and the ocean's shore would traverse Wisconsin, Iowa, and Kansas, and extend thence to Texas. More extensive changes than this have repeatedly occurred in the past.

The character of the original sediments may be changed by chemical and dynamic action so as to produce metamorphic rocks. In the metamorphism of a sedimentary rock, just as in the metamorphism of an igneous rock, the substances of which it is composed may enter into new combinations, or new substances may be added. When these processes are complete the sedimentary rock becomes crystalline. Such changes transform sandstone to quartzite, limestone to marble, and modify other rocks according to their composition. A system of parallel division planes is often produced, which may cross the original beds or strata at any angle. Rocks divided by such planes are called slates or schists.

Rocks of any period of the earth's history may be more or less altered, but the younger formations have generally escaped marked metamorphism, and the oldest sediments known, though generally the most altered, in some localities remain essentially unchanged.

Surficial rocks.—These embrace the soils, clays, sands, gravels, and bowlders that cover the surface, whether derived from the breaking up or disintegration of the underlying rocks by atmospheric agencies or from glacial action. Surficial rocks that are due to disintegration are produced chiefly by the action of air, water, frost, animals, and plants. They consist mainly of the least soluble parts of the rocks, which remain after the more soluble parts have been leached out, and hence are known as residual products. Soils and subsoils are the most important. Residual accumulations are often washed or blown into valleys or other depressions, where they lodge and form deposits that grade into the sedimentary class. Surficial rocks that are due to glacial action are formed of the products of disintegration, together with bowlders and fragments of rock rubbed from the surface and ground together. These are spread irregularly over the territory occupied by the ice, and form a mixture of clay, pebbles, and bowlders which is known as till. It may occur as a sheet or be bunched into hills and ridges, forming moraines, drumlins, and other special forms. Much of this mixed material was washed away from the ice, assorted by water, and redeforming another gradation into sedimentary deposits. Some of this glacial wash was deposited in tunnels and channels in the ice, and forms characteristic ridges and mounds of sand and gravel, known as osars, or eskers, and kames. The material deposited by the ice is called glacial drift; that washed from the ice onto the adjacent land is called modified drift. It is usual also to class as surficial rocks the deposits of the sea and of lakes and rivers that were made at the same time as the ice deposit.

AGES OF ROCKS.

Rocks are further distinguished according to their relative ages, for they were not formed all at one time, but from age to age in the earth's history. Classification by age is independent of origin; igneous, sedimentary, and surficial rocks may be of the same age.

When the predominant material of a rock mass is essentially the same, and it is bounded by rocks of different materials, it is convenient to call the mass throughout its extent a *formation*, and such a formation is the unit of geologic mapping.

Several formations considered together are designated a *system*. The time taken for the deposition of a formation is called an *epoch*, and the time taken for that of a system, or some larger fraction of a system, a *period*. The rocks are mapped by formations, and the formations are classified into systems. The rocks composing a system and the time taken for its deposition are given the same name, as, for instance, Cambrian system, Cambrian period.

As sedimentary deposits or strata accumulate the younger rest on those that are older, and the relative ages of the deposits may be discovered by observing their relative positions. This relationship holds except in regions of intense disturbance; sometimes in such regions the disturbance of the beds has been so great that their position is reversed, and it is often difficult to determine the relative ages of the beds from their positions; then *fossils*, or the remains of plants and animals, are guides to show which of two or more formations is the oldest.

Strata often contain the remains of plants and animals which lived in the sea or were washed from the land into lakes or seas or were buried in surficial deposits on the land. Rocks that contain the remains of life are called fossiliferous. By studying these remains, or fossils, it has been found that the species of each period of the earth's history have to a great extent differed from those of other periods. Only the simpler kinds of marine life existed when the oldest fossiliferous rocks were deposited. From time to time more complex kinds developed, and as the simpler ones lived on in modified forms life became more varied. But during each period there lived peculiar forms, which did not exist in earlier times and have not existed since; these are characteristic types, and they define the age of any bed of rock in which they are found. Other types passed on from period to period, and thus linked the systems together, forming a chain of life from the time of the oldest fossiliferous rocks to the present.

When two formations are remote one from the other and it is impossible to observe their relative positions, the characteristic fossil types found in them may determine which was deposited first.

Fossil remains found in the rocks of different areas, provinces, and continents, afford the most important means for combining local histories into a general earth history.

Colors and patterns.—To show the relative ages of strata, the history of the sedimentary rocks is divided into periods. The names of the periods in proper order (from new to old), with the color or colors and symbol assigned to each, are given in the table in the next column. The names of certain subdivisions of the periods, frequently used in geologic writings, are bracketed against the appropriate period name.

To distinguish the sedimentary formations of any one period from those of another the patterns for the formations of each period are printed in the appropriate period-color, with the exception of the first (Pleistocene) and the last (Archean). the Pleistocene and the Archean, are distinguished from one another by different patterns, made of parallel straight lines. Two tints of the period-color are used: a pale tint (the underprint) is printed evenly over the whole surface representing the period; a dark tint (the overprint) brings out the different patterns representing formations.

PERIOD.	SYMBOL.	COLOR.
Pleistocene	P	Any colors.
Neocene { Pliocene / Miocene }	N	Buffs.
Eocene (including Oligocene)	E	Olive-browns.
Cretaceous	K	Olive-greens.
Juratrias { Jurassic / Triassic }	J	Blue-greens.
Carboniferous (including Permian)	C	Blues.
Devonian	D	Blue-purples.
Silurian (including Ordovician)	S	Red-purples.
Cambrian	Є	Pinks.
Algonkian	A	Orange-browns.
Archean	Æ	Any colors.

Each formation is furthermore given a letter-symbol of the period. In the case of a sedimentary formation of uncertain age the pattern is printed on white ground in the color of the period to which the formation is supposed to belong, the letter-symbol of the period being omitted.

The number and extent of surficial formations of the Pleistocene render them so important that, to distinguish them from those of other periods and from the igneous rocks, patterns of dots and circles, printed in any colors, are used.

The origin of the Archean rocks is not fully settled. Many of them are certainly igneous. Whether sedimentary rocks are also included is not determined. The Archean rocks, and all metamorphic rocks of unknown origin, of whatever age, are represented on the maps by patterns consisting of short dashes irregularly placed. These are printed in any color, and may be darker or lighter than the background. If the rock is a schist the dashes or hachures may be arranged in wavy parallel lines. If the rock is known to be of sedimentary origin the hachure patterns may be combined with the parallel-line patterns of sedimentary formations. If the metamorphic rock is recognized as having been originally igneous, the hachures may be combined with the igneous pattern.

Known igneous formations are represented by patterns of triangles or rhombs printed in any brilliant color. If the formation is of known age the letter-symbol of the formation is preceded by the capital letter-symbol of the proper period. If the age of the formation is unknown the letter-symbol consists of small letters which suggest the name of the rocks.

THE VARIOUS GEOLOGIC SHEETS.

Historical geology sheet.—This sheet shows the areas occupied by the various formations. On the margin is a *legend*, which is the key to the map. To ascertain the meaning of any particular colored pattern and its letter-symbol on the map the reader should look for that color, pattern, and symbol in the legend, where he will find the name and description of the formation. If it is desired to find any given formation, its name should be sought in the legend and its color and pattern noted, when the areas on the map corresponding in color and pattern may be traced out.

The legend is also a partial statement of the geologic history. In it the symbols and names are arranged, in columnar form, according to the origin of the formations—surficial, sedimentary, and igneous—and within each group they are placed in the order of age, so far as known, the youngest at the top.

Economic geology sheet.—This sheet represents the distribution of useful minerals, the occurrence of artesian water, or other facts of economic interest, showing their relations to the features of topography and to the geologic formations. All the formations which appear on the historical geology sheet are shown on this sheet by fainter color-patterns. The areal geology, thus printed, affords a subdued background upon which the areas of productive formations may be emphasized by strong colors. A symbol for mines is introduced at each occurrence, accompanied by the name of the principal mineral mined or of the stone quarried.

Structure-section sheet.—This sheet exhibits the

In cliffs, canyons, shafts, and other natural and artificial cuttings, the relations of different beds to one another may be seen. Any cutting which exhibits those relations is called a *section*, and the same name is applied to a diagram representing the relations. The arrangement of rocks in the earth is the earth's *structure*, and a section exhibiting this arrangement is called a *structure section*.

The geologist is not limited, however, to the natural and artificial cuttings for his information concerning the earth's structure. Knowing the manner of the formation of rocks, and having traced out the relations among beds on the surface, he can infer their relative positions after they pass beneath the surface, draw sections which represent the structure of the earth to a considerable depth, and construct a diagram exhibiting what would be seen in the side of a cutting many miles long and several thousand feet deep. This is illustrated in the following figure:

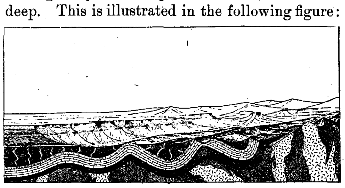


Fig. 2.—Sketch showing a vertical section in the front of the picture, with a landscape beyond.

The figure represents a landscape which is cut off sharply in the foreground by a vertical plane that cuts a section so as to show the underground relations of the rocks.

The kinds of rock are indicated in the section by appropriate symbols of lines, dots, and dashes. These symbols admit of much variation, but the following are generally used in sections to represent the commoner kinds of rock:

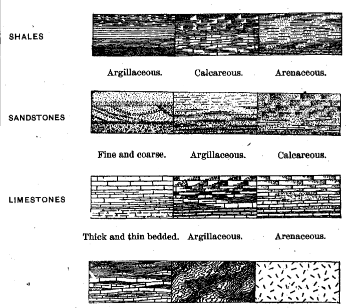


Fig. 3.—Symbols used to represent different kinds of rock.

The plateau in fig. 2 presents toward the lower land an escarpment, or front, which is made up of sandstones, forming the cliffs, and shales, constituting the slopes, as shown at the extreme left of the section.

The broad belt of lower land is traversed by several ridges, which are seen in the section to correspond to beds of sandstone that rise to the surface. The upturned edges of these beds form the ridges, and the intermediate valleys follow the outcrops of limestone and calcareous shales.

Where the edges of the strata appear at the surface their thickness can be measured and the angles at which they dip below the surface can be observed. Thus their positions underground can be inferred.

When strata which are thus inclined are traced underground in mining, or by inference, it is frequently observed that they form troughs or arches, such as the section shows. But these sandstones, shales, and limestones were deposited beneath the sea in nearly flat sheets. That they are now bent and folded is regarded as proof that forces exist which have from time to time caused the earth's surface to wrinkle along certain zones.

On the right of the sketch the section is composed of schists which are traversed by masses of igneous rock. The schists are much contorted and their arrangement underground can not be inferred. Hence that portion of the section delineates what is probably true but is not

In fig. 2 there are three sets of formations, distinguished by their underground relations. The first of these, seen at the left of the section, is the set of sandstones and shales, which lie in a horizontal position. These sedimentary strata are now high above the sea, forming a plateau, and their change of elevation shows that a portion of the earth's mass has swelled upward from a lower to a higher level. The strata of this set are parallel, a relation which is called *conformable*.

The second set of formations consists of strata which form arches and troughs. These strata were once continuous, but the crests of the arches have been removed by degradation. The beds, like those of the first set, are conformable.

The horizontal strata of the plateau rest upon the upturned, eroded edges of the beds of the second set at the left of the section. The overlying deposits are, from their positions, evidently younger than the underlying formations, and the bending and degradation of the older strata must have occurred between the deposition of the older beds and the accumulation of the younger. When younger strata thus rest upon an eroded surface of older strata the relation between the two is an *unconformable* one, and their surface of contact is an *unconformity*.

The third set of formations consists of crystalline schists and igneous rocks. At some period of their history the schists were plicated by pressure and traversed by eruptions of molten rock. But this pressure and intrusion of igneous rocks have not affected the overlying strata of the second set. Thus it is evident that an interval of considerable duration elapsed between the formation of the schists and the beginning of deposition of the strata of the second set. During this interval the schists suffered metamorphism; they were the scene of eruptive activity; and they were deeply eroded. The contact between the second and third sets, marking a time interval between two periods of rock formation, is another unconformity.

The section and landscape in fig. 2 are ideal, but they illustrate relations which actually occur. The sections in the structure-section sheet are related to the maps as the section in the figure is related to the landscape. The profiles of the surface in the section correspond to the actual slopes of the ground along the section line, and the depth of any mineral-producing or water-bearing stratum which appears in the section may be measured from the surface by using the scale of the map.

Columnar-section sheet.—This sheet contains a concise description of the rock formations which occur in the quadrangle. The diagrams and verbal statements form a summary of the facts relating to the character of the rocks, to the thicknesses of the formations, and to the order of accumulation of successive deposits.

The rocks are described under the corresponding heading, and their characters are indicated in the columnar diagrams by appropriate symbols. The thicknesses of formations are given under the heading "Thickness in feet," in figures which state the least and greatest measurements. The average thickness of each formation is shown in the column, which is drawn to a scale—usually 1000 feet to 1 inch. The order of accumulation of the sediments is shown in the columnar arrangement: the oldest formation is placed at the bottom of the column, the youngest at the top, and igneous rocks or other formations, when present, are indicated in their proper relations.

The formations are combined into systems which correspond with the periods of geologic history. Thus the ages of the rocks are shown, and also the total thickness of each system.

The intervals of time which correspond to events of uplift and degradation and constitute interruptions of deposition of sediments may be indicated graphically or by the word "unconformity," printed in the columnar section.

Each formation shown in the columnar section is accompanied by its name, a description of its character, and its letter-symbol as used in the maps and their legends.

CHARLES D. WALCOTT,
Director.

Revised June, 1897.

DESCRIPTION OF THE ROSEBURG QUADRANGLE.

As this communication is addressed to laymen as well as to geologists, technical language will be avoided as far as possible, but it will be assumed that the reader is familiar with the explanatory text inside the folio cover.

TOPOGRAPHY.

Topography of the Pacific coast.—On the Pacific slope within the United States, between the interior basin and the coast, there is a mountain belt containing three ranges, the Sierra Nevada, the Cascade, and the Coast. To the south these ranges are separated by the great valley of California, and to the north by the valley of the Willamette and Puget Sound, but near the boundary of California and Oregon they appear to run together in a complex group—the Klamath Mountains—so called after the river which has cut through them to the sea. As the limits of this group are not generally known, it may be stated that the Klamath Mountains embrace all those peaks and ridges lying between the fortieth and forty-third parallels. The Yallo Bally, Bully Choop, South Fork, Trinity, McCloud, Marble, Scott, and Salmon mountains of California, as well as the Siskiyou and Rogue River mountains of Oregon, belong to the Klamath group.

Ranges and valleys of the Pacific coast.

The Klamath Mountains are composed in large part of rocks like those of the Sierra Nevada, with traces here and there of lavas like those of the Cascade Range. Their present nucleus was an island in an ancient sea, but in their later development they are closely related to the Coast Ranges. Northward in Oregon, as well as southward in California, these ranges contain large masses of sediments of later age than those forming the bulk of the Sierra Nevada.

Coast Range.

Topography of the Roseburg quadrangle.—The Roseburg quadrangle lies between the parallels 43° and 43° 30′ north latitude and the meridians 123° and 123° 30′; its north-south length is 34.5 miles and its average east-west length is 25.2 miles, making its area 870.9 square miles. It borders the northeastern base of the Klamath Mountains, and lies between the Cascade and Coast ranges. The North Umpqua and South Umpqua rivers and the Calapooya Creek cross the quadrangle and unite near its western border, where the Umpqua enters a deep and remarkably meandering canyon, in which it passes through the Coast Range. Myrtle Creek and Deer Creek, which flow into the South Umpqua, are the largest streams wholly within the quadrangle. The branches of all the larger streams flow generally northeast or southwest, a direction which is determined for them, as we shall see later, by the position of the rocks.

Roseburg quadrangle; area, position, and drainage.

The Roseburg quadrangle is, for the most part, a hilly country, through which meander the more or less open valleys of the principal streams. The variation in altitude within the quadrangle is 4000 feet—from 300 feet, the lowest point in the canyon of the Umpqua, where it enters the Coast Range, at the northwest corner of the quadrangle, to 4300 feet, the height of Scott Mountain, one of the foothills of the Cascade Range.

Relief.

Tyee Mountain, which rises a little over 2600 feet, is a portion of the bold front of the Coast Range, facing east, and occupies the northwest corner of the quadrangle. North of the canyon of the Umpqua this escarpment is prominent for only a short distance, but south of the canyon the prominent crest continues unbroken for nearly 20 miles. This bluff marks the eastern limit of the Coast Range and is remarkable for its even summit, as illustrated in fig. 11 on the sheet of illustrations.

Tyee Mountain.

White Rock, Scott Mountain, and other prominent hills near the eastern margin of the Roseburg quadrangle are properly considered as the foothills of the Cascade Range, not only on account of their topographic position, but also on account of their structure and origin. They are the western border of the volcanic upland belonging to the mountain slope, and their front, although not sharply outlined, extends north and south, in general marking the point where the rivers, descending from the Cascade Range, emerge from their long, rugged canyons and enter the more open though hilly Umpqua Valley.

Foothills of the Cascade Range.

The Umpqua Valley hills, lying between the Coast and Cascade ranges, occupy the largest part of the Roseburg quadrangle. They have a decided general trend northeast and southwest, and give this direction to the smaller streams, but are cut across by the larger ones. The principal ridge is that of Dodson Mountain. It extends from Big Baldy by Dodson Mountain, Brushy Butte, and Lane Mountain to Buck Peak and Little River, where it meets the foothills of the Cascade Range. Although the peaks of this ridge rise to over 3000 feet, its general elevation is less than 2500. For most of its length it forms the divide between Myrtle and Deer creeks. Farther to the northwest the ridges, although preserving their general trend, are frequently crossed by transverse streams. The range extending northeast from Wilbur has greatest persistence and merges into the foothills at Yellow Butte.

Umpqua Valley hills.

The flat lands of the quadrangle are closely confined to the lines of drainage, and in general the larger the stream the greater the expanse of flat land in the valley bottom. This feature is better displayed along the South Umpqua than along any other stream within the district. At the southern edge of the quadrangle is the Missouri bottom, extending nearly to Myrtle Creek, where the river enters a canyon in which it passes through the Dodson Mountain ridge. Below Dillard the bottom again widens and continues to near Roseburg. The greatest expanse is at Garden Valley, below Roseburg, where the north and south forks join. Opposite Woodruff Mountain the bottom again narrows, but a short distance below, about the mouth of the Calapooya, it spreads out, forming Coles Valley. This alternation of wide and narrow portions is a feature of the other large stream valleys in the quadrangle, but is not so well developed as along the south fork.

Umpqua Valley bottoms.

One of the largest stretches of broad valley bottom is in Camas Swale, which is drained by Wilbur Creek into the north fork. It is much larger in proportion to the size of the stream by which it is drained than any of the other valleys of the quadrangle, a peculiarity which is explained later under the heading "Origin of the topography."

Camas Swale.

GEOLOGY.

SEDIMENTARY ROCKS.

On the map entitled Historical Geology is shown the distribution of thirteen formations, of which seven are sedimentary and six igneous. In the legend the formations of each great group are arranged in the order of geologic age, with the youngest above. The sedimentary rocks will be considered first, beginning with the oldest, and then the igneous rocks will be described.

JURATRIAS (?)

In northern California, upon the borders of the Klamath Mountains, the occurrence of Devonian, Carboniferous, and Triassic strata is well known, but in southwestern Oregon they have not yet been recognized. About Taylorville and the Great Bend of Pitt River, in California, Jurassic strata are well developed. In Oregon they have lately been discovered near the northern limit of the Klamath Mountains. At the north base of Bucks Peak, on a branch of Olalla Creek, about 5 miles southwest of Big Baldy Mountain, is a sandstone containing fossil leaves, among which Prof. William M. Fontaine recognized a number of forms found in Jurassic strata near Oroville, California, and on this account the sandstone may be provisionally referred to the Jurassic. In Bucks Peak near Olalla Creek the associated strata contain characteristic Cretaceous fossils (*Aucella piochii*). The provisional Jurassic and the Cretaceous strata are much alike, and without the aid of fossils it appears hardly possible to distinguish them. The Cretaceous strata extend from the Olalla region northeast into the Roseburg quadrangle, and it is possible that the provisional Jurassic strata do also, but of this there is doubt, as no Jurassic fossils were found there.

Radiolarian chert.—Chert is a compact, flinty rock, composed almost exclusively of silica, and is often highly colored. Some of its forms are occasionally called jasper. Red or brown and gray of various shades are the colors most frequently seen, although green is not uncommon. It is a hard, insoluble rock and usually forms ledges, but as a rule they are not so prominent as those of blue or green amphibole-schist or metagabbro, to be noted later. The reason for the smallness of the ledges is to be found chiefly in the diminutive size of the chert masses and in their fissured condition. Although very hard, chert breaks readily into small fragments. A remarkable feature of the chert is its banding, due to alternating sheets of different colors. The banding is occasionally conspicuous, the layers ranging from a small part of an inch to several inches in thickness. At other places the chert is massive and the colors are irregularly intermingled, so as to give a mottled effect. It is permeated by a multitude of small veins of quartz, with a few of calcite. The veins are generally so small as to be scarcely visible to the naked eye.

General character of the radiolarian chert.

Seventeen small areas of this chert are noted on the map. There are probably a number of others which were not seen. With the exception of two masses near Peel and one at the head of Buckhorn Creek, they occur near the southwest corner of the quadrangle. They are associated chiefly with the Myrtle formation and metagabbro, but are also found inclosed in serpentine. The masses are usually lenticular in form, and their small size is so common a feature as to suggest that they originated in very local conditions. This peculiarity, however, may be due, at least in part, to the intrusion of igneous rocks, and also to the overlapping of later formations. The largest area is nearly 2 miles west of Winston, in secs. 17 and 18, T. 26 S., R. 6 W., where the chert occurs in a variety of colors and textures. A short distance northwest of the area referred to above is another of considerable size, and near by, to the southeast, are a number of small ones, all of which are within so short a distance of one another that they may have once belonged to a continuous mass which has since been broken up by the intrusion of the associated igneous rocks.

Distribution of the chert.

The chert, though so uniformly compact, is found on microscopical examination to be made up chiefly of silica in several conditions. Much of it is amorphous, producing under the microscope between crossed nicols no visible effect upon transmitted light, but the remainder is clearly doubly refracting, either granular like quartz or fibrous like chalcedony. The clear granular quartz is confined chiefly to the veins, and most of the chalcedony to small patches and spots representing organisms. The chert is hard enough to scratch feldspar, has a specific gravity of about 2.54, and in a closed tube yields but little water. It is evident, therefore, that the silica of the chert is in the form of quartz rather than in that of opal.

Structure and composition of the chert.

A thin section of the dull red chert, when examined under a microscope, is found to contain a multitude of marine organisms—radiolaria—which are siliceous and have furnished the chief source of the silica in some of the chert. These microscopic fossils in the chert are rarely preserved well enough for recognition, but where most distinct and abundant they form 90 per cent of the mass. Where less distinct they generally appear as round, clear spots of chalcedony without a trace of structure. The variegated jaspery forms are so modified, apparently by the deposition of secondary silica, that their original condition is in large measure obscured. In some of the cherts not even a trace of these organisms is present, and yet their general distribution is evidence that much if not all of the masses of the chert originated under essentially the same conditions. While we may with confidence regard the chert as a marine formation, the special conditions of its accumulation are not clear. Judging from what is known of similar deposits now forming on the ocean bottom, it would be supposed that the chert originated as radiolarian ooze where the sea was over 14,000 feet deep, in regions far from the land areas, and therefore not reached by sediments from the shore. Within the chert of the Roseburg quadrangle no trace of shore sediments has been found, although in a number of cases sandstones completely envelop the chert. As it is certain that the associated sandstones are comparatively near-shore deposits, if the cherts are of deep-sea origin the sea must have changed rather suddenly from shallow to deep, and back again to shallow, to bring about the conditions necessary to the deposition of the successive beds. The associated beds do not clearly record such movements, and on account of the local distribution of the chert in numerous small masses Professor Lawson has suggested that they may have been formed in large measure by siliceous springs which supplied the silica and rendered the conditions favorable for its precipitation and the abundant development of radiolaria. It should be noted, however, that siliceous spring deposits are usually of opal rather than quartz, and contain from 3 to 6 per cent of water. Mr. W. Valentine made partial analyses of three cherts containing from 1.08 to 1.80 per cent of water given off above a temperature of 110°. Of the one containing most water 90 per cent is made up of radiolarian remains. The specific gravity of these cherts is about 2.5, and their hardness is nearly 7. In these respects the chert differs from the ordinary deposits of siliceous springs.

Origin of the chert.

The age of the chert in any particular case is a matter of much doubt, notwithstanding the large number of radiolarian fossils it may contain. Such fossils are rarely of special value as indicators of geological age, except in a broad sense. The ones examined by Professor Hinde in chert from Buriburi Ridge, near San Francisco, and illustrated in Mr. Ransome's paper on the geology of Angel Island, were regarded as Jurassic or Cretaceous. Some of the radiolaria found in the Roseburg chert appear to be identical with those in the chert noted above.

Age of the chert Mesozoic.

The intimate association of the chert with the Myrtle formation along Willis Creek tends to show that it is Cretaceous, although the exact relations of the two formations are not clearly exposed, and the evidence as far as seen is not conclusive. More trustworthy data are afforded by the large amount of chert contained in the fossiliferous sandstones and conglomerates of the Myrtle formation. The chert fragments appear to be essentially the same as that exposed in the larger areas. No certain radiolaria have been seen in these fragments, but the suggestive clear, round spots of chalcedony, so common in the cherts, occur rather frequently also within the pebbles and grains of sand of the Myrtle formation. These fragments are often intersected by veins that are limited to the pebble in which they occur and that were evidently formed in the chert before the fragment was broken from its parent mass. This relation suggests an age for much of the chert clearly earlier than the Myrtle formation, which was itself probably laid down during the early portion of the Cretaceous period. The sandstone containing the Jurassic leaves, as far as examined microscopically, is too fine grained to afford satisfactory evidence concerning its relation to the chert.

Chert older than Myrtle formation.

CRETACEOUS.

Myrtle formation.—The Myrtle formation is composed of limestones, conglomerates, sandstones, and shales. The limestones of this formation have been mapped separately as the Whitsett limestone-lentils, and will be considered later. The other strata vary greatly from place to place, so that the continuity of the individual beds can not be traced for great distances. Conglomerate and sandstone, being harder than shale, outcrop more frequently, though they are generally less abundant. Upon close examination, especially under the microscope, the sandstones of the Myrtle formation are found to contain, besides fragments of other

Composition of the Myrtle formation.

material, a large number of kaolinized feldspar grains, with much quartz and occassionally considerable biotite, all of which were derived from the disintegration of a granitic rock such as prevails in the region of Grants Pass.

The stratification of these beds is rarely well marked, so that the position of the mass is often not clearly determinable and its thickness is a matter of only general approximation. **Thickness of the Myrtle formation.** Judging from the range of fossils, the greatest thickness should be expected in the valley of Myrtle Creek. The beds are here arranged in the form of a trough, with conglomerates and sandstones on both sides and shales and thinner sandstones in the middle, standing at a high angle. An approximate estimate of the thickness at this point is about 6000 feet.

The outcrops of the Myrtle formation are confined to the southern half of the quadrangle, with the largest area near the southwest corner. **Distribution of the Myrtle formation.** The conglomerates and sandstones of this area are rather more abundant than the shales, and a number of the hills formed of them rise to an altitude of over 2000 feet. Northeastward the belt narrows, because other rocks of later development overlap it; and finally, at the head of Buckhorn Creek, about 11 miles east of Roseburg, it entirely disappears beneath the Umpqua formation. It is interrupted at several points by small areas of other rocks, both sedimentary and igneous, the one near Winston being the largest and most irregular and complex.

The next area of importance is that of Myrtle Creek. It extends into the quadrangle along the south fork of the Umpqua from Cow Creek, on the southwest, and continues to the head of Bilger Creek, where it ends abruptly against the metagabbro. Smaller areas occur on the ridge of Dodson Mountain, on the spur south of Buck Fork, and along Days Creek at the southeast corner of the quadrangle. Although there is some conglomerate in the area northwest of White Rock, conglomerate generally increases in amount and coarseness southwestward, pointing to the source of the material from a shore line in that direction.

Fossils have been found in the Myrtle formation at about a dozen localities, and in every case they have been characteristic forms. Among those peculiar to the later portion of the formation, **Fossils of the Myrtle formation.** *Pecten operculiformis* (fig. 7) is most common. *Trigonia æquicostata* (fig. 8) is also rather common. The strata containing these fossils and many others associated with them were first found well developed near Horsetown, Shasta County, California, and for this reason they were called the Horsetown beds. It may therefore be said that the later portion of the Myrtle formation is of the same geological horizon as the Horsetown beds of California. According to Mr. T. W. Stanton they represent the lower half of the upper Cretaceous. In the Roseburg quadrangle the fossils of this horizon have been found only in the middle portion of the Myrtle Creek area and throughout the area along Days Creek.

The fossils which are characteristic of the earlier portion of the Myrtle formation are *Aucella crassicollis* (fig. 6) and *Aucella piochii* (fig. 5). The first named is a robust form, and is characteristic of the latest portion of the Aucella-bearing beds immediately adjoining the Horsetown beds. In California these forms are found in the Knoxville beds, which lie below and are older than the Horsetown beds. The earlier portion of the Myrtle formation occupies the whole of the large area about Dillard, and the border of the Myrtle Creek mass, of which the middle portion belongs to the later horizon.

Whitsett limestone-lentils.—The northeastern portion of the largest area of the Myrtle formation contains a number of lentils of limestone, one of which occurs near J. H. Whitsett's, in secs. 14 and 15, T. 28 S., R. 5 W. The limestone is a massive gray rock, dipping steeply to the northwest, and has a maximum thickness of 60 feet. To the northeast it may be traced for a third of a mile. Among the few, generally imperfect fossils found, Mr. T. W. Stanton has recognized *Opis californica* and a species of Hoplites, either closely related to or identical with *Hoplites dilleri*, found in the Knoxville beds of California.

On the south fork of Deer Creek are two other limestone lentils which have no fossils visible to the naked eye, but which by reason of their location have been considered as belonging with the Whitsett limestone, in the **Other lentils.** Cretaceous. They range in color from mottled gray to nearly white, and contain numerous minute calcareous organisms. The limestone of these lentils is much veined and spotted with clear calcite or reddish material, both calcareous and siliceous. The reddish siliceous portion contains microscopic spots like radiolaria. The limestone is so compact as to make it susceptible of a high polish, and it has been used for marble.

The most northeastern lentil is in sec. 14, T. 27 S., R. 4 W. It is the smallest of the series, being about 15 feet in thickness, and contains an abundance of microscopic fossils, both calcareous and siliceous. To the southwest, in line with the lentils already mentioned, are two others, known as Flints and Coopers. Flints is the largest limestone mass of the quadrangle, and contains traces of fossils once supposed to be Paleozoic but now regarded by Messrs. Girty and Schuchert, who reexamined them, as of doubtful age. Upon structural grounds these lentils have always been regarded as of the same age as the lentil at Whitsetts—i. e., Cretaceous.

Metamorphic rocks.—The metamorphic rocks of the Roseburg quadrangle occur in over a dozen small areas and are chiefly schists containing amphibole or mica. **Variety of metamorphic rocks.** Amphibole is the more abundant, and may be either blue or green. The blue form, in some cases at least, appears to be glaucophane. It is the more striking and perhaps the more characteristic, but is scarcely as common as the green. Epidote also is frequently seen, and in places is so abundant as to make the greater portion of the rock. Although these rocks are well exposed in places, their contact with other rocks can not be seen, and the outcrops, as a whole, do not afford satisfactory evidence concerning the origin of the metamorphic masses.

Blue amphibole-schist, although sometimes rather massive, generally has a well-defined schistose structure. Its pale-blue color **Amphibole-schist.** is due to the occurrence of the principal component in thin irregular blade-like or fibrous forms which have an approximate parallel arrangement. Bluish-green and green amphibole is also commonly associated with it. Muscovite-mica, garnet, quartz, feldspar, zoisite, and rutile are present, but in varying and subordinate quantities. There is present also in some cases another mineral which is colorless and has prismatic cleavage like pyroxene. It is so inclosed by the amphibole and associated with oxide of iron as to suggest that pyroxene was the original mineral, and blue amphibole secondary, derived from it. One of the most prominent and characteristic ledges of the amphibole-schist is near the road southwest of Roseburg, about 1 mile from Winston bridge. It is represented by fig. 1 in the sheet of special illustrations. The larger part of this outcrop is blue amphibole-schist, but locally it becomes very micaceous and full of garnets as well as pyrite. In some ledges green amphibole is associated with blue, and may become so abundant as to predominate and characterize the rock. Next to the blue and green amphibole-schist mica-schist is the most common.

The metamorphic rocks occur in numerous areas, of which the largest embraces scarcely a hundred acres, and the smallest but a few square yards. **Distribution of the metamorphic rocks.** Nearly all their outcrops occur within the large area of the Myrtle formation, and are associated not only with the conglomerates, sandstones, and shales of that group, but also with chert and metagabbro. The masses are usually lenticular in shape, but are sometimes irregular. Their longest axes extend northeast and southwest, parallel to the general strike of the Myrtle formation.

The sporadic distribution of the amphibole-schists shows that their origin is not to be ascribed to regional metamorphism, but rather to some form of local metamorphism. Their intimate association with igneous rock on the one hand and with sedimentary rocks **Origin of the amphibole-schists.** on the other, points emphatically to some form of contact metamorphism as their source. Further than this the evidence is less specific. The parent rock from which they were derived and the peculiar conditions under which the changes were effected are not clearly understood, although in a few cases there are suggestions as to the course of events. The associated sedimentary rocks of the Myrtle formation are not infrequently much affected by pressure, and the shearing rendered them fissile, like schist, but in such cases they remain clearly fragmentary, and among the new minerals formed no trace of blue amphibole was observed. This is surprising when we remember that Lawson and Ransome have found in the neighborhood of San Francisco not only blue amphibole in the little-altered sandstones, but also the intermediate stages, showing their complete alteration to amphibole-schist. The apparent absence of a transition phase in the Roseburg quadrangle is possibly due to lack of contact exposures. The only sedimentary rock of that region containing a suggestion of its alteration by the intruded igneous rock to blue amphibole-schist is the chert, and in this case also the evidence is very meager.

On the other hand, the contemporaneous or subsequent changes which occurred within the intruded masses are more clearly in the direction of producing the peculiar blue amphibole-schists, although it is evident that the wide range in composition of metamorphic rocks must indicate a mode of alteration that permits the transfer of much matter.

The Umpqua formation, like the Myrtle, is made up of conglomerates, sandstones, and shales, which were deposited upon the floor of the open ocean not far off shore, but it **Upheaval, erosion, and intrusion of igneous rocks.** must not be supposed that the epoch in which the former was deposited immediately succeeded that of the deposition of the latter. There was a long interval between the completion of the Myrtle formation and the beginning of the Umpqua formation. This interval is represented in other parts of Oregon and California by 5000 or more feet of marine sediments, known to geologists as the Chico formation. The absence of the Chico from the Roseburg region indicates that some time after the Myrtle formation was laid down the Roseburg region was raised above the sea and exposed to extensive erosion, but it again subsided beneath the ocean, to receive the deposits of the Umpqua formation.

The topmost portion of the Myrtle formation was removed during this period of erosion, but how much was washed away it is not possible to estimate. It is not improbable that the strata equivalent to a part of the Chico formation of California have been removed, for the beds immediately beneath them are the topmost ones of the Cretaceous series now exposed in the Roseburg quadrangle, and a study of the structure of that region demonstrates that much has been washed away.

Within the interval between the Myrtle and the Umpqua epochs, most likely in connection with the uplifting of the region, the molten igneous masses of gabbro, and perhaps also of saxonite, were intruded from below into and through the Myrtle formation, developing along some portions of their contact with the sedimentary rocks the peculiar metamorphic rocks already described.

EOCENE.

Umpqua formation.—The Umpqua epoch was initiated by a subsidence which brought in the sea from the northwest over the land until the Roseburg quadrangle and the **Unconformity of Umpqua and Myrtle formations.** adjacent region lay completely submerged beneath the ocean. The shore from which the sediments were then derived lay only a short distance away to the southward. The tilted strata of the Myrtle formation then formed the sea bottom in the Roseburg region and the Umpqua beds were laid down unconformably upon their upturned edges.

The Umpqua formation is composed of an extensive series of conglomerates, sandstones, and shales, with traces here and there of calcareous siliceous beds which, although **Conglomerate, sandstone, and shale.** of small extent, on account of their exceptional character are treated separately as the Wilbur formation. Conglomerates are rather uncommon, and occur either near the southeastern limit of the mass or close to the areas of diabase. In the first case they are made up largely of pebbles derived from the rocks to the southeast, and the farther in that direction the formation is followed the larger the pebbles become. In the neighborhood of White Rock the cobblestones are occasionally nearly a foot in diameter, and among them are found fragments of sandstones and shale containing Aucella, which clearly point to the Myrtle formation as their source.

The conglomerates of Clover Creek, 6 miles northeast of Roseburg, near their contact with the surrounding diabase, are composed largely of igneous material like that of the adjacent rock. This exposure is a type of many others, and shows that a part of the Umpqua formation is younger than the diabase from which the sediment came. The sandstones and shales form by far the greater portion of the Umpqua formation, but, like the conglomerate, none of the beds have sufficient individuality to enable them to be traced more than a few miles. Small beds of coal have been found with sandstone and shales near the eastern border of the quadrangle. Although the shales predominate, they are so thin bedded and are intermingled with such a multitude of sandstones that the individuality of any particular stratum is lost in the mass and makes no impression upon the features of the landscape. There are some heavier sandstones, but they rarely attain a thickness of over 50 feet, and even in such cases the rock is generally made up of comparatively thin layers. The oscillating conditions recorded in the large series of alternating sandstones and shales are due to causes not yet clearly understood. The characteristic topography is shown in fig. 4.

The Umpqua is by far the thickest formation in the Roseburg quadrangle, but on account of the lack of good exposures of certain members of the series the whole could **Thickness of Umpqua formation.** not be accurately measured. The best outcrops are along the Little River, where a continuous section of a portion of the series is well exposed. This portion has a thickness of about 7500 feet. It is interrupted on the northwest by the large mass of diabase, beyond which, as shown in Section B, about 4500 feet of still lower beds are seen, making a total thickness of approximately 12,000 feet for the entire exposed formation. It increases in thickness to the northwest and has wide distribution throughout the Coast Range.

The Umpqua formation occupies a much larger area than any other in the Roseburg quadrangle. The main body lies west and north of Roseburg and extends northeast to **Distribution of Umpqua formation.** near the limit of the quadrangle, where it disappears beneath the lava at the western foot of the Cascade Range. It extends up Little River, and appears in patches above Peel, on Cavitt Creek, and about White Rock. These separated patches are remnants of a once continuous sheet that lapped to the southeast far over upon the older rocks. Fossils have not been found in all of these isolated patches, but are abundant near the mouth of Cavitt Creek. Westward and northward the Umpqua formation stretches far beyond the Roseburg quadrangle and plays an important rôle in the make-up of the whole country west of the Cascade Range.

The Umpqua formation in places contains many fossils, some of which are especially characteristic. Along Little River, for a distance of 3½ miles from its mouth, they **Fossils in the Umpqua formation.** are abundant. *Cardita planicosta*, represented in fig. 9, is common. Fig. 10 illustrates *Turritella uvasana*, another important and characteristic Eocene form.

Wilbur tuff-lentil.—The Wilbur formation, sometimes locally called "cement rock," is made up of a sedimentary bed which is comparatively uniform in physical features **Physical features of the Wilbur formation.** as well as in composition. It is a compact and fine-grained, hard shale, which weathers a dull reddish brown, but on a fresh fracture appears much darker. Ordinarily it closely resembles, in general appearance, some forms of igneous rocks, such as diabase or basalt, but is usually more fissile and not quite so heavy.

In acid this rock effervesces rather slowly at a multitude of points for a little while, and then the effervescence ceases, indicating that the rock is composed in small part of carbonate of lime. By examining a thin section under a microscope it may be seen that the rock is composed largely of two kinds of sedimentary material, igneous and organic. **Igneous material in the Wilbur formation.** All the sediment is very fine; only a comparatively small part is in fragments sufficiently large and characteristic for determination. Among the inorganic material are grains of feldspar and augite, and minute particles of igneous rock like the superficial portion of the adjacent diabase. Besides these, in some cases, there is much of a brownish-yellow to coffee-brown substance which ranges from transparent to translucent and is isotropic. It occurs in angular fragments, and rarely it contains gas cavities like those of pumice. It is quite readily soluble in hydrochloric acid. Its physical characteristics and associations suggest that it is glassy igneous material, like palagonite, in a more or less altered state.

Organic material in the Wilbur formation.

With the material already noted are many minute bodies, some of which are certainly organisms. A portion of these are calcareous; the others are apparently insoluble in hydrochloric acid and are probably siliceous. The calcareous ones are not so numerous as the others, and vary greatly in form. The majority of them are cellular, like globigerina, and concerning their organic nature there can be no doubt. The siliceous ones are usually nearly circular in section, and range from .02 to .16 of a millimeter in diameter. The complete form must be approximately spheroidal, with a radial fibrous structure. Although the regularity in form, size, and structure suggests that they are organisms, the fact that the radial arrangement extends to the center favors the view that they are concretions. However, no trace of banded concentric structure, such as is most common in concretions, was observed.

Distribution of the Wilbur formation.

The Wilbur formation is of small thickness and extent. Its separate patches lie within the Umpqua formation, approximately in line, close to the northwest border of the great mass of diabase, and have been traced with interruptions from a point 2 miles west of Wilbur northeast to the Calapooya, a distance of about 13 miles. In the small area near Banks Creek it is richest in palagonite, as well as calcareous organisms, and the curious grains with radial fibers. The minute fossils contained in this rock afford but little evidence concerning its age. There can be no doubt, however, that it belongs to the Eocene, for it is interstratified with the Umpqua formation, which contains characteristic fossils.

Tyee sandstone.—The Tyee sandstone is the principal sandstone of the Roseburg quadrangle and occupies about 28 square miles. At its northwest corner it immediately overlies the Umpqua formation, from whose sandstones it differs chiefly in being heavier bedded and containing more conspicuous scales of mica. It forms the prominent eastern escarpment of the Coast Range from Tyee Mountain to Camas Valley, as illustrated in the farthest distance of fig. 1 on the sheet of special illustrations. Where well exposed midway of this course it is a massive sandstone having a thickness of about 1000 feet. Near its middle is a thin layer which locally contains leaf impressions. At Basket Point, on the Umpqua River, just beyond the limits of the map, *Cardita planicosta* and other characteristic Eocene fossils are abundant.

Distribution and position of Oakland limestone-lentil.

Oakland limestone-lentils.—The Oakland limestone is an impure limestone which is generally known in the vicinity of Oakland as "cement rock." Only three small areas, rather widely separated, were observed: one by the road nearly a mile northeast of Oakland; another at the head of Green Valley; and the third on Starr's ranch, about 4 miles northeast of Umpqua Ferry. None of the areas are more than an acre in extent, and the size had to be exaggerated to make them visible on the map. It is probable that there are other localities yet unobserved. Near Oakland the rock is a bluish shaly limestone that falls to pieces rather readily upon exposure. It contains, besides a few fossils, brownish veins and nodules of various sizes up to 4 feet in diameter. At Starr's ranch the limestone is full of broken shells, and hangs upon the gentle slope at the foot of a steep one formed by the outcropping edges of the Umpqua formation. The fossiliferous limestone, as well as the sandstone of the slope above, dips gently to the northwest, suggesting that the limestone is conformably interstratified with the Umpqua formation. The fossils, however, according to Dr. Dall, do not permit such an interpretation. It is much younger than the Umpqua formation, and must rest upon it unconformably.

Fossils and age of Oakland limestone-lentil.

The fossils recognized by Dr. Dall in this formation are "marine shells, Lucina, Venus, Corbula, Natica, Turritella, etc. They are distinctly *not typical Eocene*, but are probably Oligocene, most likely upper Oligocene, representing the change from land conditions to marine, which was followed by the marine Miocene, not here represented, but which may have many species in common with these transition beds."

IGNEOUS ROCKS.

Within the Roseburg quadrangle there are seven recognized types of igneous rocks. Mentioned in the order of age, beginning with the oldest, they are metagabbro, serpentine, dacitic rocks, diabase, andesite, rhyolite, and basalt. They will be considered in the order given.

Composition and structure of the metagabbro.

Metagabbro.—This rock, throughout the greater portion if its mass, has a texture like granite, and was composed at first essentially of plagioclase feldspar of the lime-soda variety and pyroxene. It is therefore a gabbro. Since then it has been altered, under metamorphic influences, and the resulting rock is called metagabbro, to indicate that a change has taken place. The change usually consists in transforming the pyroxene into hornblende or chlorite; less frequently in changing the feldspar to an aggregate of quartz, muscovite, and epidote, or to kaolin. Although in much of the rock these changes are more or less complete, there are large masses especially fine grained where the pyroxene and feldspar remain practically unaltered. The texture, although still granite-like, is usually somewhat ophitic, like that of diabase. Quartz is occasionally a constituent of importance. The relative proportion of feldspar and pyroxene is in general nearly the same, the feldspar being somewhat more abundant than the pyroxene, but occasionally rocks are found made up almost exclusively of either feldspar or pyroxene. Another variation was noted by the road on the hill south of Ruckles station, where serpentine is associated with gabbro. A microscopic examination of the gabbro shows that it once contained olivine, from which the serpentine originated. The relation of this olivine-bearing rock to the metagabbro proper was not fully worked out. The pyroxene of the gabbro related to the serpentine has a finer laminated structure, like diallage, and in this respect it differs from the gabbro from which the metagabbro was derived.

Distribution and age of the metagabbro.

Metagabbro occupies a large area in the southeastern portion of the quadrangle, embracing almost completely the drainage of Myrtle Creek. There are a number of small areas surrounded by the Myrtle formation. The principal of these is near Winston. These small masses appear to have been intruded in the Myrtle formation, but of this no conclusive evidence could be found. The relation of the metamorphic rocks to the metagabbro is such as to show that they originated along its contact with adjacent rocks. The adjacent rocks appear to belong to the Myrtle formation, and if so the metagabbro must be younger than that portion of the Cretaceous period represented by the Myrtle formation.

Derivation of the serpentine.

Serpentine.—The serpentine of the belt extending southwest from near Brushy Butte is derived from saxonite, a variety of peridotite. The original constituents of this rock were chiefly olivine and enstatite, both of which have generally changed to serpentine. In some places there are remnants of the original minerals to tell the story of its derivation. This is the rock with which the nickel ore of Riddles is associated.

Distribution of the serpentine.

The serpentine of the Roseburg quadrangle is confined to a comparatively narrow belt which crosses the river just below Myrtle Creek and extends northeast along the prominent ridge to Brushy Butte. Here it is interrupted by the metagabbro, but, continuing in the same direction, one finds half a dozen smaller areas of serpentine in the metagabbro about Lane Mountain, and then the larger mass about Peel, where the serpentine passes beneath the newer lavas of the western border of the Cascade Range. The only areas noted lying without this belt are near the Roberts Creek schoolhouse and on a hill three-fourths of a mile directly east of Alexander Butte. All the masses outlined appear to be derived from the alteration of saxonite. Other masses of serpentine within the metagabbro, and not mapped, are probably derived from olivine-gabbro.

Composition and structure of the dacitic rocks.

Dacitic rocks.—Under this head have been included a number of related rocks which vary considerably among themselves. Their best types are found within the small areas near the road a short distance northwest of Myrtle Creek. One type is decidedly porphyritic with well-developed crystals of quartz and feldspar, while another is non-porphyritic, and in its external appearance closely resembles quartzite. The second type, examined in thin section under a microscope, is found to be made up of quartz and feldspar, much if not most of which is plagioclase with numerous shreds of hornblende. The groundmass of the first type is like this, except that it is much finer grained.

The porphyritic type occurs also in the area southeast of Myrtle Creek post-office and along Peavine Ridge east of Louis Creek, but in these places the phenocrysts are not so prominent and all are of quartz. In the area near Headquarters, on the divide between Slide Creek and Buck Fork, the rocks are materially different. They are much altered and less siliceous, although portions closely resemble rhyolitic lavas.

While the age of these rocks can not be determined, it appears that some masses of them are younger than the metagabbro and serpentine through which they have penetrated to reach the surface.

Composition and structure of the diabase.

Diabase.—The igneous rocks already noted have been associated particularly with the Myrtle formation. We now come to one which is associated almost exclusively with the Umpqua formation. Diabase is usually a dark, heavy, dense igneous rock. It is composed principally of augite and plagioclase of the lime-soda variety, so arranged that the grains of augite occupy the angular spaces between the crystals of feldspar, giving to the rock its characteristic ophitic structure. Olivine is frequently present. Near its contact with other rock, where it cooled rapidly, the diabase contains much amorphous matter, which is occasionally glassy.

Age of the diabase.

A short distance north of Roseburg, on the railroad, a large piece of Umpqua shale is inclosed in the diabase, which along the contact is rendered glassy by the chilling influence of the shale. The exposure is illustrated in fig. 2 on the sheet of illustrations. East of Oakland, as well as along Little River and the north fork of the Umpqua, the diabase occurs clearly as a dike penetrating the Umpqua formation, and judging from these examples it is fair to conclude that the diabase is generally younger than the oldest portion of the Umpqua formation, and has been erupted through it.

On the other hand, the conglomerates of the Umpqua formation associated with the diabase contain many pebbles of diabase derived from the adjoining rock, and in fact the conglomerate is sometimes made up chiefly of such material. The diabase welled up from below and flowed out upon the sea floor, and in connection with this extrusion of the material there was some explosive volcanic action that furnished much of the fine material for the Wilbur formation. These igneous products are found interstratified with the Umpqua formation, and characteristic fossils occur intermingled with them, fixing the age of the diabase extrusion as within the Eocene.

Andesites.—Along the eastern border of the Roseburg quadrangle there are three varieties of lava derived from the volcanoes belonging to the Cascade Range. These lavas differ considerably in chemical composition, a difference which has had its effect in determining the structure and mineral composition of the lava. Only three of these varieties which have thus arisen will be considered: andesites, rhyolites, and basalts.

The andesites of the Roseburg quadrangle are generally the oldest of the three types of volcanic rocks noted on the map. They occur in a large area about Scott Mountain and to the northeastward, but their distribution is not accurately known, on account of the difficulty of finding satisfactory outcrops by which their outlines might be traced through the dense forest. The andesites within this area are pyroxene-andesites, more closely related to the basalts than those of some of the small areas farther north. The most typical ones of the whole region perhaps occur on the eastern edge of the quadrangle, immediately north of the mouth of Cavitt Creek, but all belong to essentially the same group of pyroxene-andesites. Most of the pyroxene in these rocks is augite, but hypersthene is common, and in a few cases it predominates over the augite. None of the andesites are clearly porphyritic to the naked eye, but under the microscope many are conspicuously so, and the groundmass frequently appears to be a dense mass composed chiefly of extremely minute crystals of feldspar.

Rhyolites.—The rhyolites, having the highest percentage of silica, are the lightest of lavas, both in color and in weight. Those of the Roseburg quadrangle are usually nearly white, although they are sometimes brownish with well-defined lines due to the flow of the mass. There are numerous small included fragments, and on a fresh fracture quartz is usually abundant. Farther northwestward, to the east of Cavitt Creek, the color is somewhat deeper brown, but beyond Little River it is lighter, making white cliffs along the crests, which may be seen from afar.

In areal extent the rhyolites stand next to the andesites, and, overlying them in forming the uplands, they are in general of later age. Those north of the north fork of the Umpqua, however, appear to underlie the andesites and are probably older.

Basalts.—The basalts, having a smaller percentage of silica and a larger percentage of metals, especially iron, are usually darker colored and heavier than the andesites and rhyolites. Notwithstanding the fact that there are about a dozen distinct areas of basalt in the Roseburg quadrangle, their total extent is far less than that of either of the associated lavas. The basalts are normal in structure and composition. Some flows are rich in olivine, others in pyroxene, a portion of which is hypersthene. Although prominent crystals (phenocrysts) are not common, those of feldspar are more frequently seen than those of either olivine or pyroxene. There are no well-preserved cinder cones or volcanic piles to mark the orifices from which the basalts, rhyolites, and andesites escaped. The region has suffered too much erosion to permit their preservation.

ORIGIN OF THE TOPOGRAPHY.

Through the atmosphere the forces of the sun act upon the land surface and affect the rocks in various ways. In Oregon one of the most active agents is rain, by which the soil is washed into the streams and swept away to the sea. This process, continued without upheaval or subsidence, gradually reduces the general elevation of the land. The soft rocks being more easily washed away than the hard ones, the latter remain to form hills. If the process be long continued, broad valleys may be excavated, and if the original elevation was great enough, the masses of harder rock remaining may constitute mountains. The prominent escarpment along the eastern front of the Coast Range is due chiefly to the hard sandstones, which have resisted erosion during the development of the Umpqua Valley. The beds of the Roseburg region, containing many shales and thin-bedded sandstones, are softer than the massive sandstones of the Coast Range, and have lost more in the process of degradation.

Within the Roseburg quadrangle the present diversity of the surface features is due almost wholly to a corresponding distribution of hard and soft rocks. The hills upon the eastern border of the quadrangle are made up of hard lavas. Those about Roseburg, shown in fig. 3 and also at the left in fig. 11 of the sheet of illustrations, are of diabase, a hard rock. The hills about Myrtle Creek and the prominent ridge extending from Lane Mountain to Big Baldy are composed largely of metagabbro and serpentine, although in places the prominences upon the flanks of the ridge are due to hard masses of conglomerate, like that just north of the town of Myrtle Creek.

Some of the sandstones of the Myrtle formation make prominent spurs upon both sides of the river between Ruckles and Dillard, but farther northward, about Roseburg, Winchester, and Wilbur, and extending northeast to the Calapooya, the most prominent hills are all due to the presence of diabase, which is an especially hard, durable rock. Northwest of this diabase belt the bed of the Calapooya is cut in softer sandstones and shales, except upon the east, where these are protected by igneous rocks, and upon the northwest, where the massive Tyee sandstone makes the most prominent even-crested bluff of the region, as shown in fig. 11.

In the course of the long-continued process of wearing away a vast thickness of surface rocks, the streams met varying obstacles, to which they adjusted themselves. Circumstances sometimes give to one stream advantages over its neighbor, which enable it to encroach upon and finally to capture part of its neighbor's waters. An event of this sort is well illustrated in the Roseburg quadrangle, and explains the origin of Camas Swale, a broad valley without a stream proportionate to its size. Camas Swale is drained by Wilbur Creek, a small stream that flows by Wilbur into the north fork of the Umpqua. One of its principal branches rises in the upper end of Camas Swale, close to the canyon in which the Calapooya crosses the head of the swale and Oakland Ridge, to reach the valley of Oldham Creek. The divide between the two streams at Fair Oaks is so low as to suggest that the Calapooya may once have flowed through Camas Swale directly to Umpqua Ferry, or that, by way of Wilbur Creek, it entered the north fork of the Umpqua several miles below Winchester. Camas Swale is the work of a much larger stream than that which flows through it to-day, and that the Calapooya once flowed through it is indicated not only by the fact that Camas Swale is continuous with the Calapooya Valley above Fair Oaks, but also by the fact that among the pebbles at the lower end of Camas Swale there are numerous fragments of recent lavas, such as could be brought down by the Calapooya only. In those days the water of Oldham Creek reached the Umpqua, as it now does, at the point known as Umpqua Ferry, but by a much shorter and more direct route than that of the Calapooya, if the Calapooya entered the north fork near Winchester. Furthermore, Oldham Creek flowed along the strike of soft rocks; consequently, it had a steeper grade and deepened its valleys more rapidly than the Calapooya, giving strength to the lateral streams rising in the ridge south and southeast of Oakland. These cut their channels back into the ridge, and finally the ridge was cut through by these lateral streams, and the Calapooya was diverted into Oldham Creek. Thus the head of the ancient Calapooya has been cut off and its waters have been captured by a branch of Oldham Creek, leaving the lower course of the ancient Calapooya occupied by a much smaller stream—Wilbur Creek.

The divide at the west end of Camas Swale, where Wilbur Creek turns south, is very low, and in fact the broad, flat plain of Camas Swale continues across it to the river at Umpqua Ferry. This fact, as well as many others, which have not been mentioned, indicate that the physiographic history of the region has been very complex.

In the direction and character of the drainage lines of the Roseburg region, there are two features worthy of mention: (1) The subordinate streams nearly all flow approximately northeast or southwest, along the softer beds, parallel to the strike of the rocks. (2) On the other hand, the master streams, like the south fork of the Umpqua, for example, flow directly across the beds and cut through the Coast Range to the sea. A remarkable feature of this stream is its crooked course; it meanders from side to side in great curves. This feature is even more pronounced in the Coast Range just beyond the northwest corner of the quadrangle, where, to reach a point 7 miles away, the river travels over 20 miles. Meandering courses characterize streams flowing at a very low grade, and it is under such conditions that meandering courses originate. The crooked course of the Umpqua may be regarded as inherited from an early condition of gentle slopes, when much of the material which has since been removed was yet in place and the country was flat and near the level of the sea. Since then the region has been upheaved and the Umpqua Canyon cut, but in such a way as not to lose the original meandering course of the stream. Traces of the gentle features of the early topography in which the meandering course of the Umpqua originated are yet preserved in the flat summits of the Coast Range.

The uplifting of the land by which the ancient plain of erosion was raised far above the sea was not uniform throughout the region. Some streams had their fall increased and were made to cut more rapidly, while in other streams the effect was reversed. Each stream left its record in the form of hills and valleys, but these have been largely modified by subsequent erosion, so that the history is read in detail with difficulty. The geologic epoch during which these gentle features already referred to were developed can not be clearly made out from a study of the Roseburg region, but it was subsequent to the close of the Eocene. The epoch may be determined more closely by studying the Neocene deposits and the series of elevated beaches upon the western slope of the Coast Range.

ECONOMIC GEOLOGY.

To display more clearly the mineral resources of the Roseburg quadrangle, an Economic sheet has been prepared, showing the location of the prospects, quarries, and mines, together with the areal distribution of the Oakland limestone, Tyee sandstone, Wilbur tuff, and Whitsett limestone, all of which may be of economic importance.

SANDSTONES.

Myrtle formation.—Sandstone is abundant in the Myrtle formation, but has been in most places so fractured at the time the rocks were folded that large pieces of it suitable for building can not be readily obtained. However, at several places near Myrtle Creek it has been quarried and used for foundations, and there are many other places where foundation material could be obtained.

Umpqua formation.—The Umpqua formation contains many beds of sandstone, and generally they are much less fractured than those of the Myrtle formation. For this reason they are better for building purposes. In color they are yellow, gray, or light brown, and the color is stable. The cement is in part calcareous, so that the rock is soft and easily trimmed. Many of the thinner beds are more durable, affording better material for walls of all kinds, although it is not so cheaply quarried, on account of the interbedded shale. Quarries have been opened by the road about 2 miles southwest of Oakland; also upon the hillside near the southeast border of Roseburg, and south of Deer Creek about a mile east of the town. The stones thus far obtained have been used almost wholly for foundations, but stone suitable for faced walls could be obtained at a number of places. A promising quarry, it is said, has recently been opened northeast of Wilbur.

The heaviest sandstone of the region is the Tyee, which is well and conveniently exposed at the lower end of Coles Valley, where the river cuts through the mountain, and the time may come when these great masses of sandstone will be needed for building purposes.

LIMESTONE AND MARBLE.

The distribution of the Whitsett limestone is shown upon the map. There are six lentils, approximately in line, and much of the mass in each case, except the one farthest northeast, will make excellent lime. The four easternmost lentils have been used for that purpose, and were they near the railroad would be used extensively, such material being rare in northwestern Oregon.

The limestone in places is susceptible of a high polish, and its rich variegated colors, mottled gray with occasional red, make it an attractive stone. Thus far marble has been cut and polished from two of the lentils, those on the south fork of Deer Creek, where a Roseburg company has put up a mill for sawing stone by water power. Fig. 12 represents a beautiful piece of marble from this quarry. If the two large lentils at Whitsetts and Flints, which are of the same age, are found upon trial to yield as good and beautiful marble as the others, they will greatly increase the amount of available material.

CEMENT.

A considerable quantity of the Oakland limestone was removed years ago and taken to Oregon City for the purpose of making cement, but the results could not be ascertained. The material is not promising for that purpose, and, furthermore, is quite limited in quantity. The Wilbur formation, a few miles northeast of the town of Wilbur, was used for the same purpose, but with no greater success. The quantity of the material is much larger than that of the Oakland limestone, but on account of poor exposure the extent of some of the areas is a matter of doubt.

For the information of those who may be interested in such material, a chemical analysis of the rock has been made, with the following result:

Analysis of Wilbur tuff.

	PER CENT.
Silica (SiO_2)	55.15
Carbon dioxide (CO_2)	3.64
Alumina (Al_2O_3), Titanium dioxide (TiO_2), Phosphoric acid (P_2O_5)	9.75
Ferric oxide (Fe_2O_3)	7.76
Lime (CaO)	10.48
Magnesia (MgO)	2.22
Potash (K_2O)	.50
Soda (Na_2O)	1.00
Water lost at 110°C.	2.70
Water lost above 110°C	6.59
Total	99.79

CLAY.

Clay has been found at a number of places, but its association is in all cases with recent valley deposits. In the pass a short distance southwest of Oakland it is used for making bricks and drain tiles. At several points near Roseburg clay has been obtained for bricks, from which most of the larger buildings of the town are constructed. There is clay in abundance to supply all local demands.

COAL.

Small beds of coal have been found upon the north fork of the Umpqua; also upon Little River and Cavitt Creek, as well as Coal Creek, which flows into the Calapooya. All of these localities are near the eastern border of the quadrangle and indicate the accumulation of vegetation along the shores of the ancient Eocene sea. None of the beds are of considerable economic importance. It is said that a wagon load was taken out on the north fork and hauled to Roseburg for trial, but its quality did not prove to be especially good. Several tons have been removed from an opening near the mouth of Cavitt Creek, for blacksmithing, but the supply is limited. An analysis of the coal from this locality shows its composition to be as follows:

Analysis of coal from near the mouth of Cavitt Creek.

	PER CENT.
Moisture	4.64
Volatile matter	38.54
Fixed carbon	39.00
Ash	17.80
Sulphur	0.44
Total	100.42

QUICKSILVER.

In the northeastern part of the quadrangle two quicksilver mines were once operated, but have since been abandoned. The deposits were, as usual, very irregular and wholly within the Umpqua sandstone, although scarcely a mile from the border of the diabase. Much of the sandstone has been bleached, as if by the action of hot springs. Promising prospects of cinnabar have not been observed in any other part of the quadrangle, but farther north several have lately been reported.

COPPER.

Near Dodson Butte there has been much prospecting for copper within the last few years. It occurs in irregular and rather sparsely distributed particles of various sizes, scattered through the serpentine and metagabbro at a number of localities, in the form of the carbonates and sulphide. That in the serpentine is almost wholly in the form of the green or blue carbonates, malachite and azurite, with traces of the sulphide, chalcopyrite, whereas in the metagabbro, lower down upon the slope of the ridge, where a larger amount of surface material has been removed, the ore is almost wholly in the form of chalcopyrite, associated frequently with pyrite. It occurs in the metagabbro of that region only a short distance from the contact with the serpentine, and impregnates the rock in belts. Several tunnels over a hundred feet in length have been run through this mass toward the serpentine, but when visited, in October, 1897, the contact had not yet been reached. Analyses of samples of the ore, representing approximately an average of the material in the mineralized belts then in view, show 2.53 per cent of copper for the 200-foot tunnel of the Black Republican mine and 5.78 per cent of copper for the open cut of the Yankee Boy.

GOLD.

The gold mines of Myrtle Creek have been worked more or less vigorously for years and are the only ones within the quadrangle that have yielded any considerable return. The mining is carried on principally during the rainy season, by placer methods, although much search has been made for paying veins. The area embracing the mines is about 7 square miles. The mines occur near Lee Creek and Buck Fork, about a place known as Headquarters. For these mines a ditch nearly 40 miles in length was once almost completed. Near Headquarters the placer mines are in material of at least two sorts: (1) the stream gravel near the bottom of the valley, and (2) the residuary material on the gentle southeastern slopes, near the summit of the divide between the two creeks. It has been estimated that $150,000 in gold has been obtained from the Myrtle Creek mines. Most of this came from the higher levels, near the heads of the gulches, where the gravel has been washed by regular hydraulic methods. The metagabbro is disintegrated to a depth of from 4 to 15 feet on this gentle slope, and its upper portion contains occasional well-rounded pebbles, remaining from the Cretaceous conglomerate which once covered the region, a patch of which still occurs on the spur a mile northeast of Headquarters. The residual material, clay and sand, is deep red, containing occasional small veins of quartz or kaolinized feldspar. The metagabbro in places contains considerable pyrite, which may be locally auriferous and may have furnished the gold, although an assay of the pyrite of the metagabbro a few miles farther northwest yielded no gold. It is believed that the gold comes chiefly, if not wholly, from the small quartz veins in the metagabbro, for quartz is occasionally found adhering to the gold which has been but little rounded by stream attrition. Lower down the slopes toward Buck Fork the grade is steeper and the residuary material has been removed, but occasional stratified deposits composed of carbonaceous clays and sands occur in the gulches resting on the bed rock and are locally auriferous. Within a hundred feet or so above the stream there are remnants of old stream terraces, in which a number of mines have been opened, and a promising plan has been suggested for turning aside Buck Fork and mining its bed, which must have received in the course of time considerable gold from the adjoining slopes. The mines on Lee Creek are close to the stream. The mine at Casteels is especially noteworthy on account of the occasional fragments of curiously weathered tusks of mammoths or mastodons which the deposit contains.

J. S. DILLER,
Geologist.

December, 1898.

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

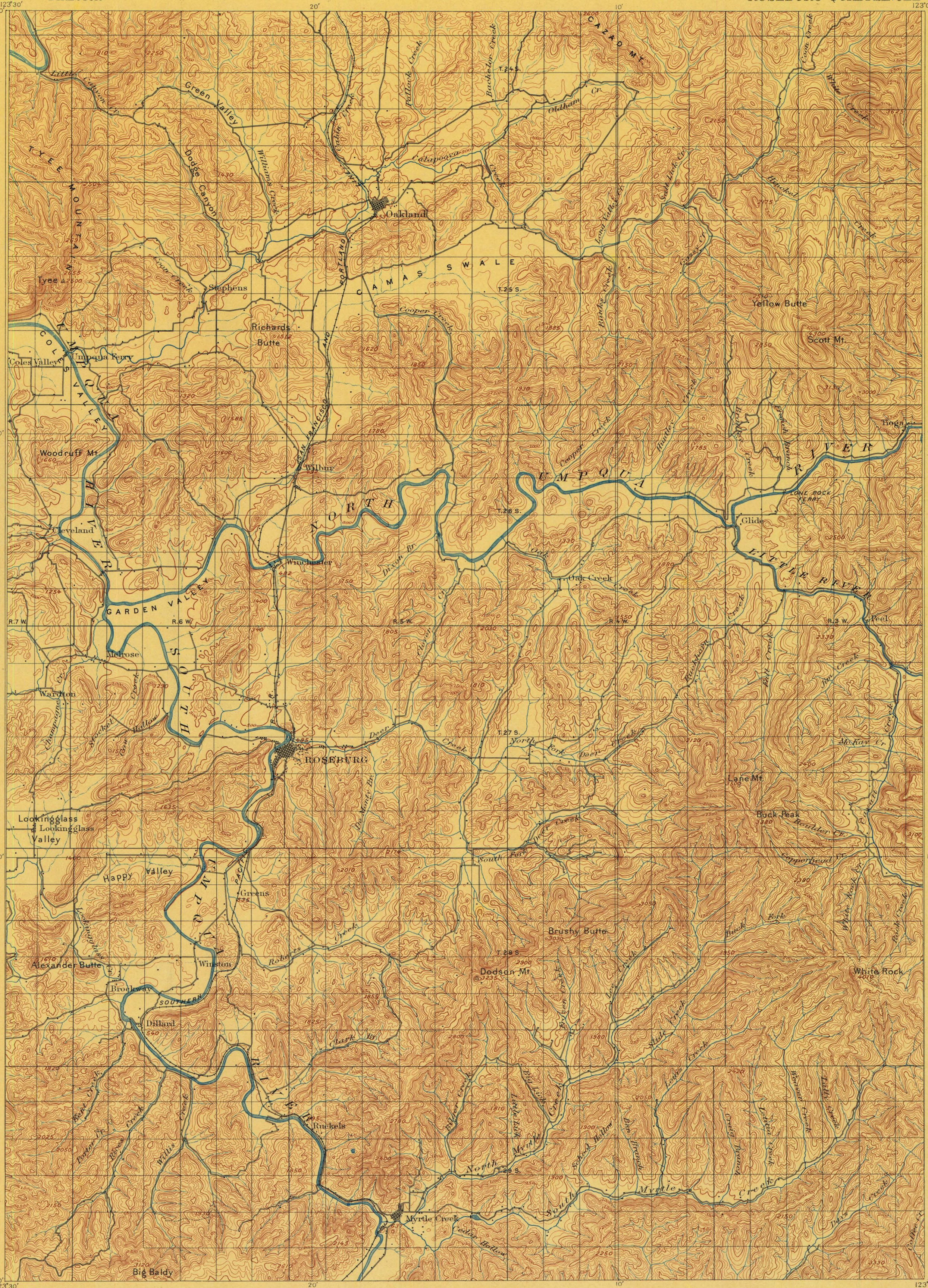
TOPOGRAPHIC SHEET

OREGON
(DOUGLAS CO)
ROSEBURG QUADRANGLE

CONVENTIONAL SIGNS

CULTURE
(printed in black)

- Roads and buildings
- Private and secondary roads
- Trails
- Railroads
- Street railroads
- Tunnels
- Bridges
- Ferries
- Fords
- Dams
- Locks
- U.S. township and section lines
- Located township and section corners
- Township and section corners not found
- Triangulation stations
- Bench marks
- Mines and quarries
- Prospects
- Shafts
- Mine tunnels *(showing direction)*
- Mine tunnels *(direction unknown)*



CONVENTIONAL SIGNS

RELIEF
(printed in brown)

- 5463 Figures *(showing heights above mean sea level instrumentally determined)*
- Contours *(showing height above sea horizontal form and steepness of slope of the surface)*
- Depression contours
- Levees
- Cliffs
- Mine dumps

DRAINAGE
(printed in blue)

- Streams
- Falls and rapids
- Intermittent streams
- Canals and ditches
- Lakes and ponds
- Intermittent lakes
- Glaciers
- Springs
- Salt marshes
- Fresh marshes
- Tidal flats

The above signs are in current use on the topographic maps. Variations from this usage appear in some maps of earlier dates.

Henry Gannett, Chief Topographer.
R.U. Goode, Geographer in charge.
Triangulation by W.T. Griswold.
Topography by E.C. Barnard.
Surveyed in 1894-95.

Scale 1/125000

Miles

Kilometers

Contour interval 100 feet.
Datum is mean Sea level.

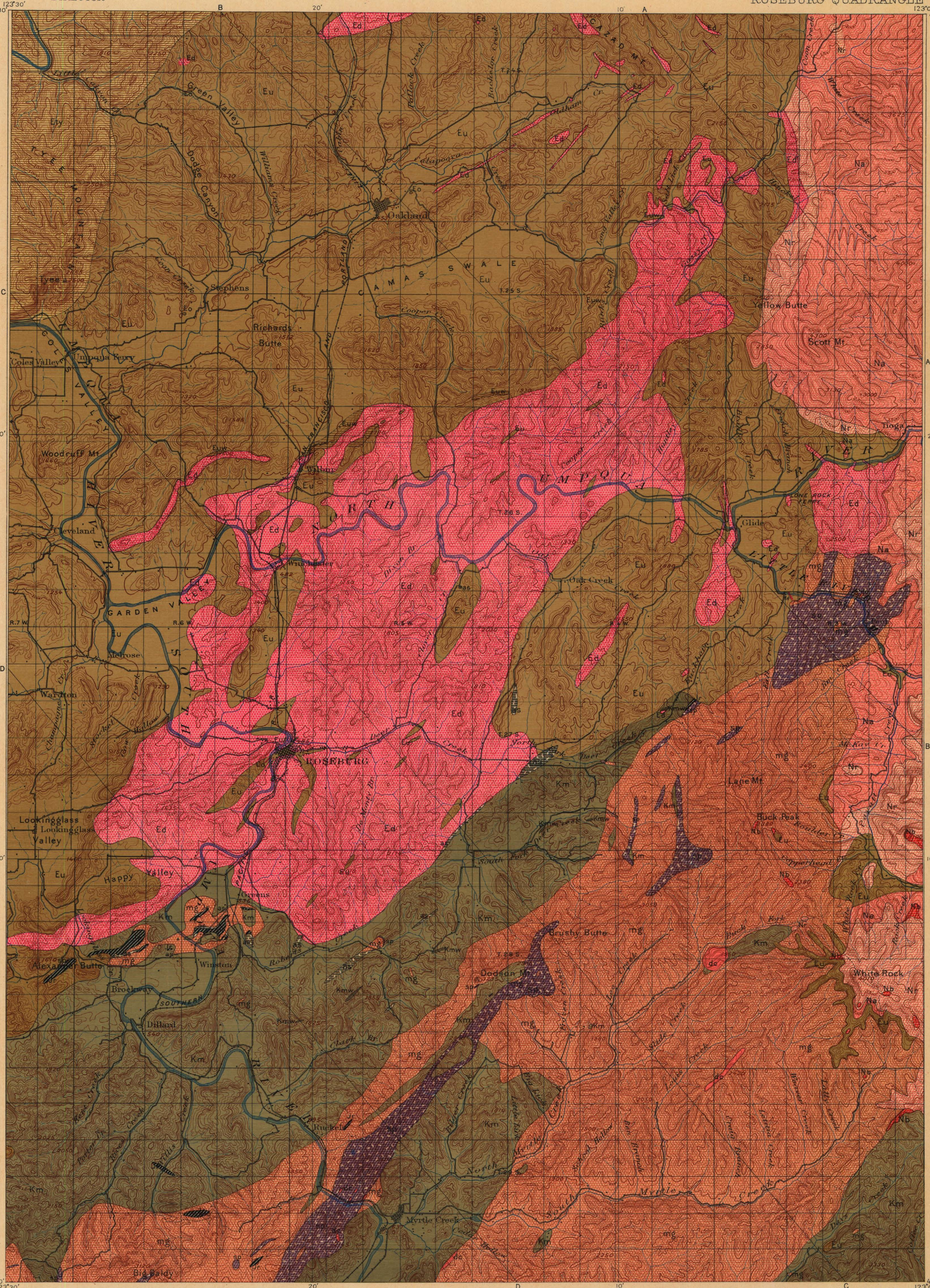
Edition of April 1898.

(Ashland 1°)

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

HISTORICAL GEOLOGY SHEET

OREGON
(DOUGLAS CO)
ROSEBURG QUADRANGLE



LEGEND

SEDIMENTARY ROCKS

(Areas of Sedimentary rocks are shown by patterns of parallel lines. Metamorphism is indicated by short dashes combined with the parallel lines.)

EOCENE

- Eo — Oakland limestone *(shaly and nodular argillaceous limestone)*
- Ety — Tyee sandstone *(massive sandstone with occasional shales)*
- Eu — Umpqua formation *(chiefly thin-bedded sandstone and shale with some conglomerate, locally containing seams of coal)*
- Euw — Wilbur tuff-lentils *(chiefly volcanic material with some calcareous, siliceous, and organic sediments occurring in the Umpqua formation)*

CRETACEOUS

- Km — Myrtle formation *(conglomerate, sandstone, and shale)*
- Kmw — Whitsett limestone-lentils *(variegated gray and red foraminiferal limestone and marble occurring in the Myrtle formation)*

CRETACEOUS ?

- as — Amphibole-schist *(blue and green amphibole-schist with some mica-schist and other schists, derived, probably, from Cretaceous formations by contact metamorphism)*

JURATRIAS ?

- Jr — Radiolarian chert *(siliceous shale and gray and red jaspery rocks)*

IGNEOUS ROCKS

(Areas of Igneous rocks are shown by patterns of triangles and rhombs. Metamorphism is indicated by short dashes combined with the Igneous patterns.)

NEOCENE

- Nb — Basalt
- Nr — Rhyolite
- Na — Andesite

EOCENE

- Ed — Diabase

- dc — Dacitic rocks *(generally conspicuously porphyritic)*
- sp — Serpentine *(derived chiefly from saxonite and partly from gabbro)*
- mg — Meta-gabbro *(the pyroxene of the original gabbro usually altered to hornblende)*

Faults

Sections

Henry Gannett, Chief Topographer.
R.U. Goode, Geographer in charge.
Triangulation by W.T. Griswold.
Topography by E.C. Barnard.
Surveyed in 1894-95.

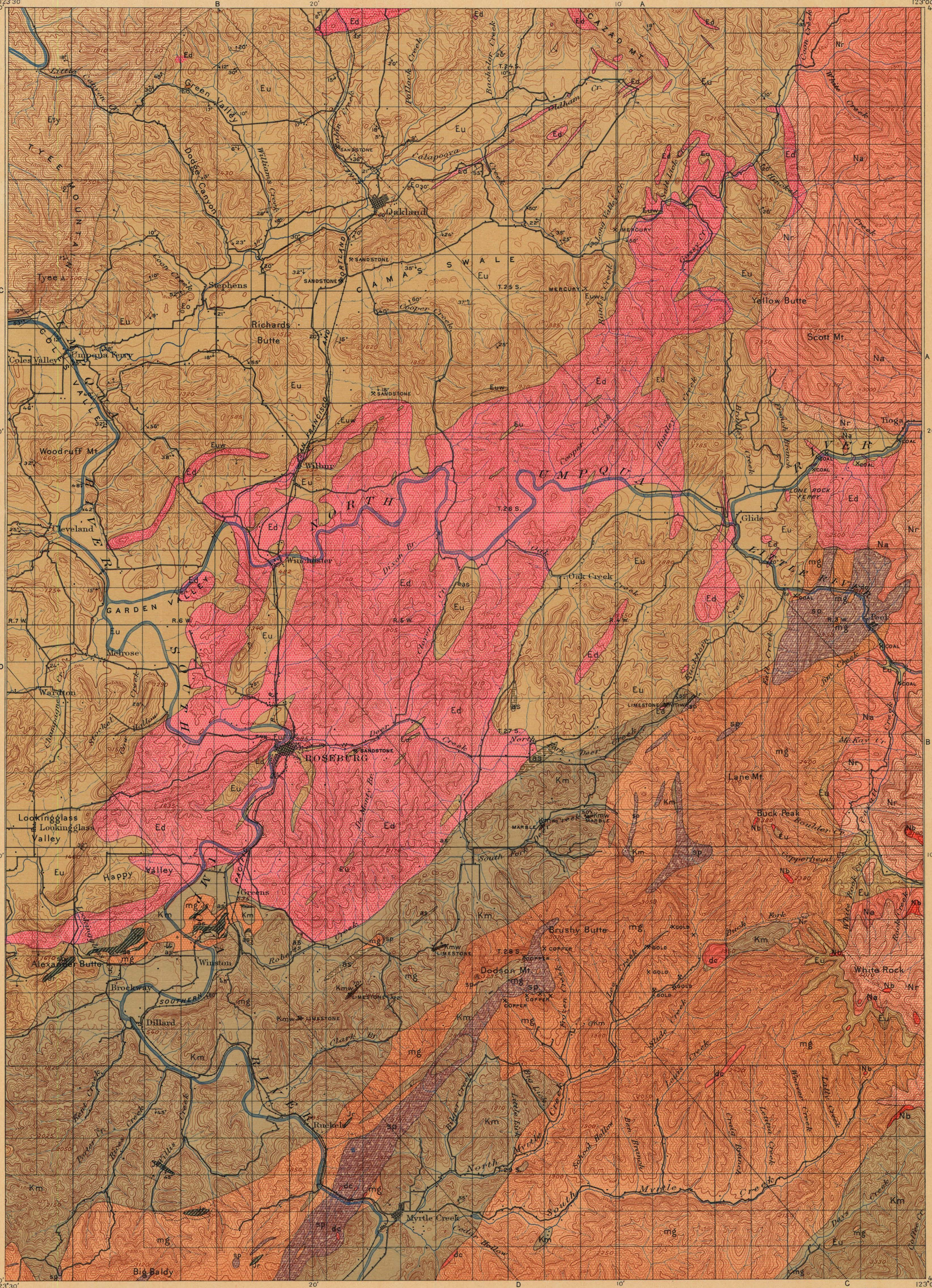
Scale $\frac{1}{125000}$
1 ½ 0 1 2 3 4 5 Miles
1 ½ 0 1 2 3 4 5 Kilometers
Contour interval 100 feet.
Datum is mean sea level.
Edition of Oct. 1898.

Geology by J.S. Diller.
Assisted by Arthur J. Collier and James Storrs.
Surveyed in 1895-96.

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

ECONOMIC GEOLOGY SHEET

OREGON
(DOUGLAS CO.)
ROSEBURG QUADRANGLE



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Scale $\frac{1}{125000}$

Contour interval 100 feet.
Datum is mean sea level.
Edition of Oct. 1898.

Geology by J.S.Diller.
Assisted by Arthur J.Collier and James Storrs.
Surveyed in 1895-96.

(Ashland) ($\frac{1}{250000}$)

LEGEND

SEDIMENTARY ROCKS

(Areas of Sedimentary rocks are shown by patterns of parallel lines. Metamorphism is indicated by short dashes combined with the parallel lines.)

EOCENE

- Eo — **Oakland limestone** *(shaly and nodular argillaceous limestone)*
- Ety — **Tyee sandstone** *(massive sandstone with occasional shales)*
- Eu — **Umpqua formation** *(chiefly thin-bedded sandstone and shale with some conglomerate, locally containing seams of coal)*
- Euw — **Wilbur tuff-lentils** *(chiefly volcanic material with some calcareous, siliceous, and organic sediments occurring in the Umpqua formation)*

CRETACEOUS

- Km — **Myrtle formation** *(conglomerate, sandstone, and shale)*
- Kmw — **Whitsett limestone-lentils** *(variegated gray and red foraminiferal limestone and marble occurring in the Myrtle formation)*

CRETACEOUS ?

- as — **Amphibole-schist** *(blue and green amphibole-schist with some mica-schist and other schists, derived, probably, from Cretaceous formations by contact metamorphism)*

JURATRIAS ?

- Jr — **Radiolarian chert** *(siliceous shale and gray and red jaspery rocks)*

IGNEOUS ROCKS

(Areas of Igneous rocks are shown by patterns of triangles and rhombs. Metamorphism is indicated by short dashes combined with the Igneous patterns.)

NEOCENE

- Nb — **Basalt**
- Nr — **Rhyolite**
- Na — **Andesite**

EOCENE

- Ed — **Diabase**

- dc — **Dacitic rocks** *(generally conspicuously porphyritic)*
- sp — **Serpentine** *(derived chiefly from saxonite and partly from gabbro)*
- mg — **Meta-gabbro** *(the pyroxene of the original gabbro usually altered to hornblende)*

Faults

Sections

20° *Dip and strike of stratified rocks*
Vertical dip and strike of stratified rocks

Mines and quarries
× *Prospects*

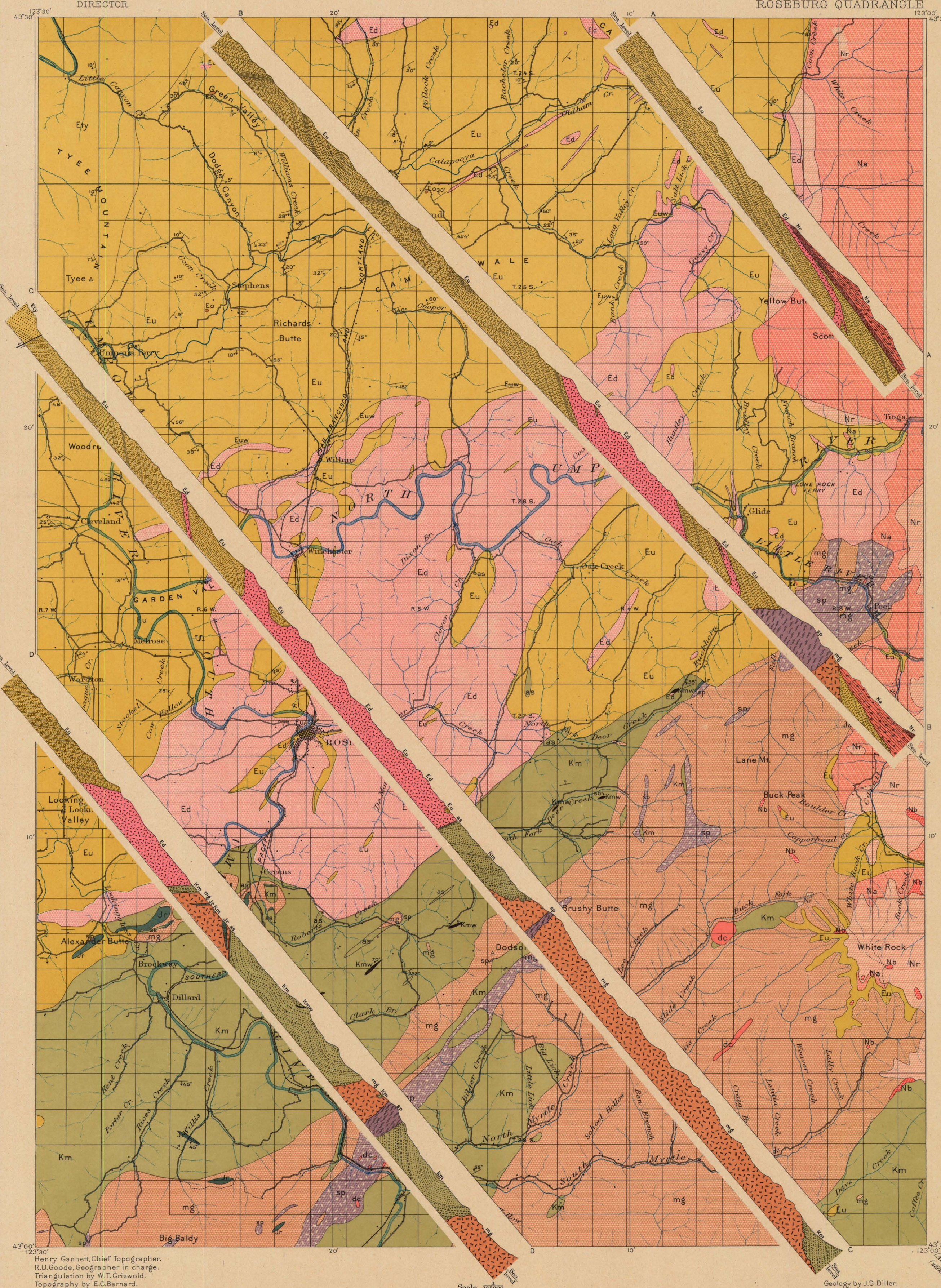
Known productive formations

- Eo — *Limestone* *(Oakland limestone, impure)*
- Kmw — *Limestone and marble* *(Whitsett limestone)*

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

STRUCTURE-SECTION SHEET

OREGON
(DOUGLAS CO.)
ROSEBURG QUADRANGLE



LEGEND

SEDIMENTARY ROCKS

SHEET SYMBOL	SECTION SYMBOL		
Eo		Oakland limestone (shaly and nodular argillaceous limestone)	EOCENE
Ety	Ety	Tyee sandstone (massive sandstone with occasional shales)	EOCENE
Eu	Eu	Umpqua formation (chiefly thin-bedded sandstone and shale with some conglomerate, locally containing seams of coal)	EOCENE
Euw		Wilbur tuff-lentils (chiefly volcanic material with some calcareous, siliceous, and organic sediments occurring in the Umpqua formation)	EOCENE
Km	Km	Myrtle formation (conglomerate, sandstone, and shale)	CRETACEOUS
Kmw	Kmw	Whitsett limestone-lentils (variegated gray and red foraminiferal limestone and marble occurring in the Myrtle formation)	CRETACEOUS
as	as	Amphibole-schist (blue and green amphibole-schist with some mica-schist and other schists, derived, probably, from Cretaceous formations by contact metamorphism)	CRETACEOUS ?
Jr	Jr	Radiolarian chert (siliceous shale and gray and red jaspery rocks)	JURATRIAS ?

IGNEOUS ROCKS

SHEET SYMBOL	SECTION SYMBOL		
Nb		Basalt	NEOCENE
Nr	Nr	Rhyolite	NEOCENE
Na	Na	Andesite	NEOCENE
Ed	Ed	Diabase	EOCENE
dc		Dacitic rocks (generally conspicuously porphyritic)	
sp	sp	Serpentine (derived chiefly from saxonite and partly from gabbro).	
mg	mg	Meta-gabbro (the pyroxene of the original gabbro usually altered to hornblende)	

Faults

20° Dip and strike of stratified rocks

Vertical dip and strike of stratified rocks

Known productive formations

Eo — Limestone (Oakland limestone, impure)

Kmw — Limestone and marble (Whitsett limestone)

Henry Gannett, Chief Topographer.
R.U. Goode, Geographer in charge.
Triangulation by W.T. Griswold.
Topography by E.C. Barnard.
Surveyed in 1894-95.

Scale $\frac{1}{125000}$
Miles
Kilometers

Edition of Oct. 1898.

Geology by J.S. Diller.
Assisted by Arthur J. Collier
and James Storrs.
Surveyed in 1895-96.

SPECIAL ILLUSTRATIONS

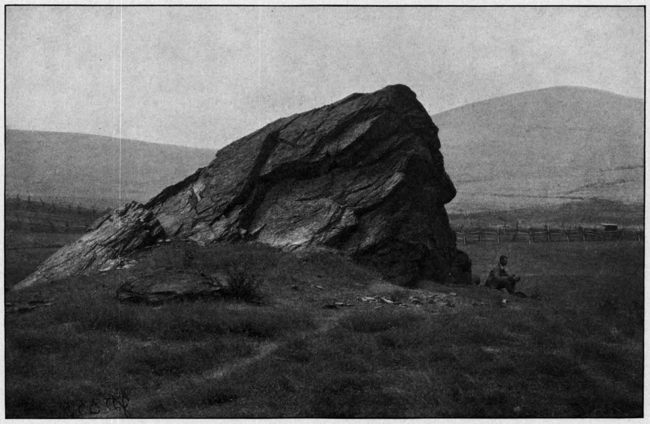


FIG. 1.—A LEDGE OF AMPHIBOLE-SCHIST 1 MILE NORTHEAST OF WINSTON BRIDGE, NEAR THE ROAD TO ROSEBURG.

The hills beyond are of chert, schist, and metagabbro

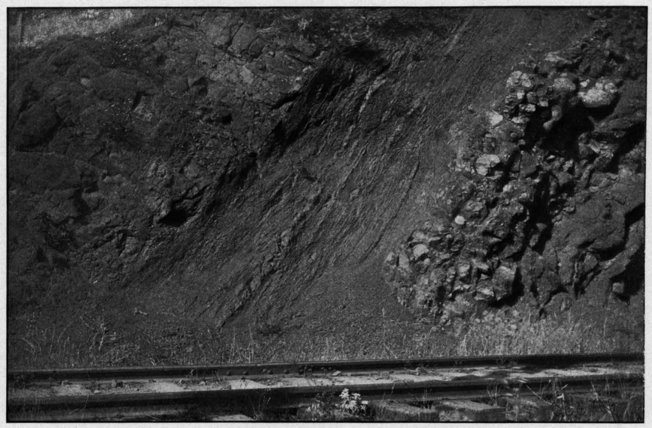


FIG. 2.—A MASS OF UMPQUA SHALE INCLOSED IN DIABASE ALONG THE RAILROAD A SHORT DISTANCE NORTH OF ROSEBURG.

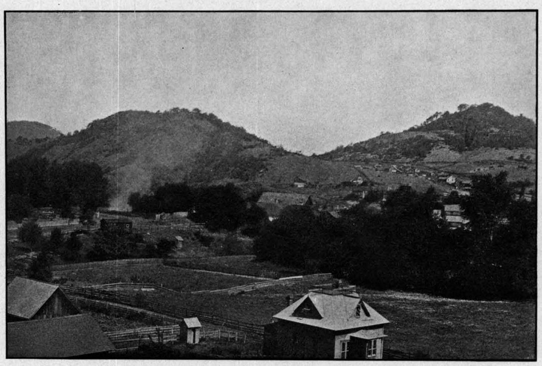


FIG. 3.—ROUNDED HILLS OF DIABASE NORTH OF ROSEBURG.

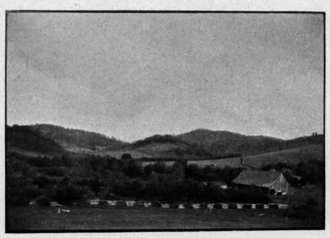
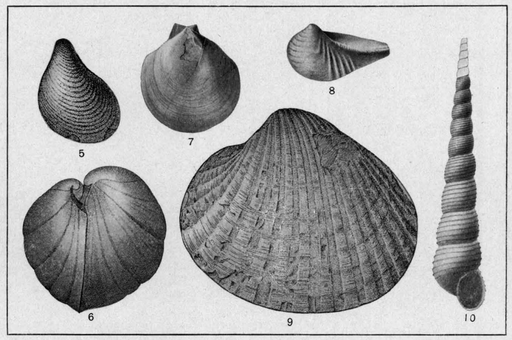


FIG. 4.—HILLS OF EOCENE SANDSTONE ON THE NORTH FORK OF DEER CREEK, 8 MILES EAST OF ROSEBURG.



CHARACTERISTIC CRETACEOUS AND EOCENE FOSSILS.

CRETACEOUS.

Fig. 5.—Aucella piochii.
Fig. 6.—Aucella crassicollis.
Fig. 7.—Pecten operculiformis.
Fig. 8.—Trigonia æquicostata.

EOCENE.

Fig. 9.—Cardita planicosta.
Fig. 10.—Turritella uvasana.

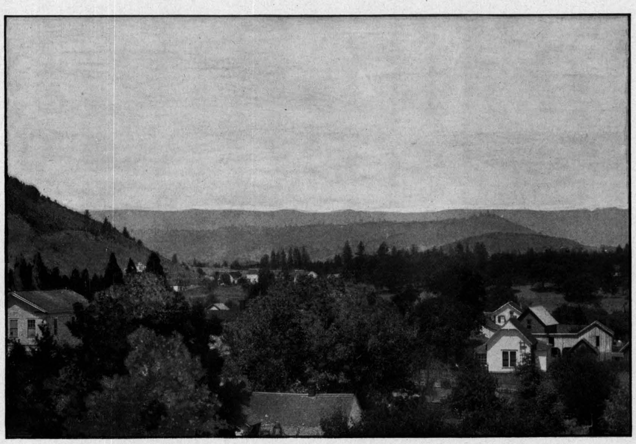


FIG. 11.—THE EVEN CREST OF THE COAST RANGE AS SEEN FROM ROSEBURG.

Near the right in the middle distance is a rounded hill of diabase, and just beyond it is a ridge of Eocene sandstone. At the left is the edge of a prominent hill of diabase.

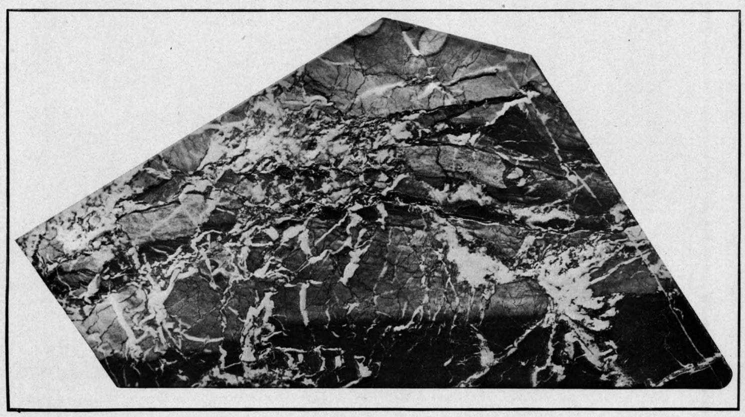


FIG. 12.—MARBLE FROM THE SOUTH FORK OF DEER CREEK.

The veins are white. The darker shades are red grading into greenish gray.