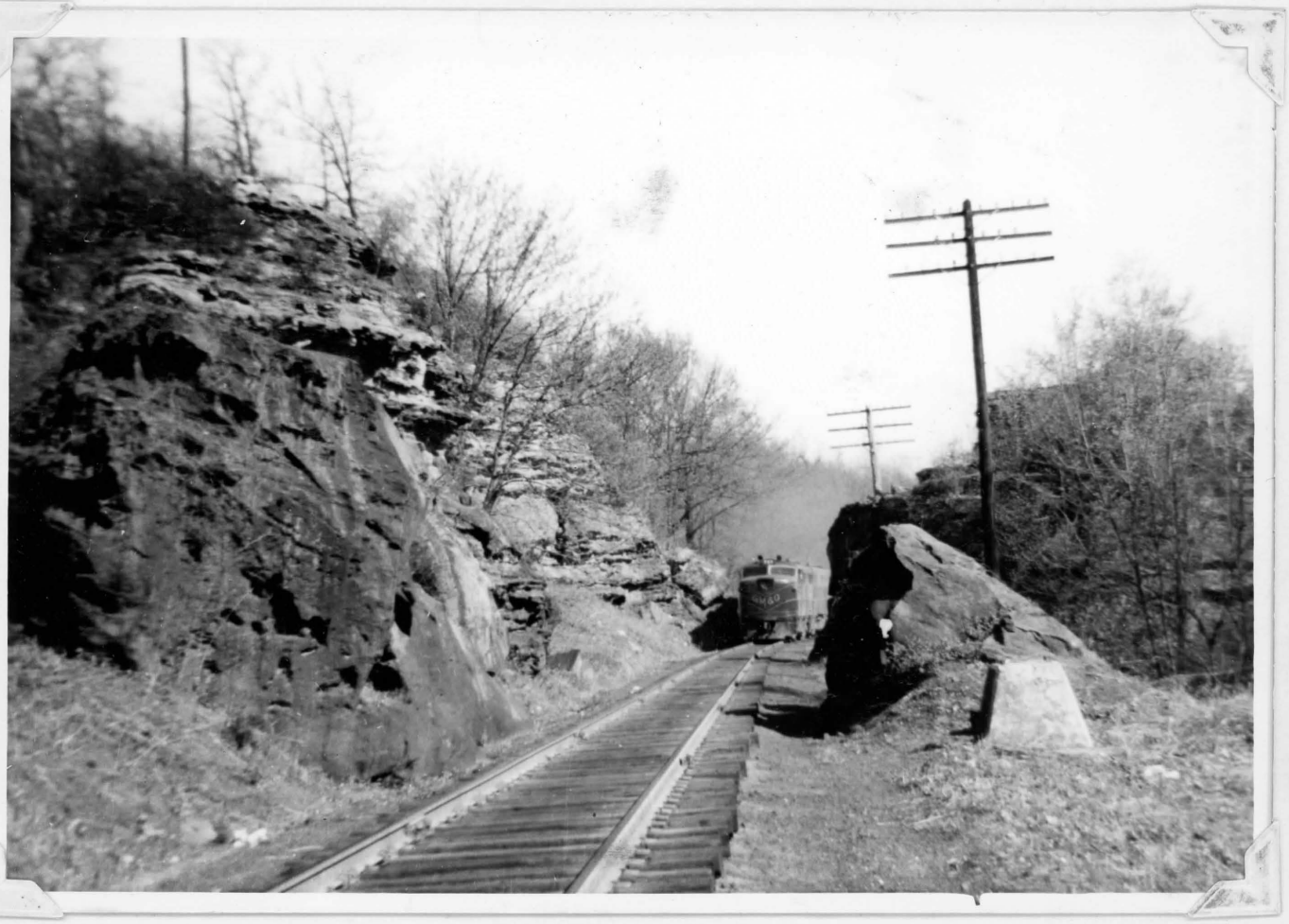
GEOLOGY OF



ALTO PASS AND VICINITY

GEOLOGY OF ALTO PASS AND VICINITY

LOCATION

Alto Pass is located in Union County of southern Illinois. The area covered in this report includes sections 10, 14, 15, 16, 21, 22, and 23 of Township 11 South, Range 2 West.

ACKNOWLEDGEMENTS

Throughout the spring semester of 1949 preparation was made to enable the students enrolled in Geology 315 to make a field trip to Giant City State Park and to study the geology of a nearby area assigned to them. W. Johnson and T.C. Buschbach carried on the field work in this area during the period of April 14 through 19, 1949. The investigation was conducted under the direction of Dr. J.L. Hough and assisted by Mr. H.E. Eveland.

Outcrops were located and studied to determine their age and stratigraphic relationship. The structure of the area has been assumed from evidence obtained from outcrops and well records.

The Cobden quadrangle topographic sheet was used as a base map, and an aerial photograph of the northern part of the area was used for supplementary information.

GEOMORPHOLOGY

Plateaus in the general area suggest the former existence of a peneplane. This is controversial?, but it is accepted that southern Illinois was level through the Mississippian Age. The settling of the Illinois basin to the north and east and the Ozark orogeny to the south and west caused the Mississippian formations to outcrop and with the aid of erosion resulted in the present topography and stream drainage. The streams in this area trend southwestward to Clear Creek. The most notable cliff formers are the Degonia and Tar Springs sandstones.

The glaciers stopped their southern advancement just north of Alto Pass, so their debris has little effect on the topography of the area. Loess and water-laid silt which are present over most of the area, tend to fill the lowlands

and create a more rolling surface.

The difference of elevation between the highest and lowest points in the area is 400 feet. The highest point is 800 feet at Alto Pass. The lowest point is 400 feet at the flood plane located near the southwestern tip of the area.

STRATIGRAPHY

All outcrops in the area are of the Mississippian system, with the Degonia formation of the Chester series being the youngest and the St. Louis formation of the Iowa series being the oldest. Pleistocene deposits, chiefly loess, appear overlying most of the area attaining a thickness of thirty feet in some places. Well records indicate that formations of the Devonian, Silurian, Ordovician, and Cambrian Ages are present beneath this area, but the formations do not outcrop.

Due to the lack of distinguishing characteristics of the Chester formations, much of the following correlation has been based upon stratigraphic relationship. True thicknesses have been supplemented by records of nearby wells. The exposed strata are considered according to their age; the oldest, which is the St. Louis limestone is considered first.

Geologic Column of Outcrops in the Alto Pass Vicinity

Cenozoic
- Pleistocene and Recent
  - Alluvium
  - Till
  - Silt

Paleozoic
- Mississippian system
  - Upper Chester series (Elvira group)
    - Degonia sandstone
    - Clore limestone
    - Palestine sandstone
    - Menard limestone
    - Waltersburg sandstone
    - Vienna limestone
    - Tar Springs sandstone
  - Middle Chester series (Homberg group)
    - Glen Dean limestone
    - *Hardinsburg sandstone
    - *Golconda limestone
    - Cypress sandstone
  - Iowa series
    - Fredonia limestone
    - St. Louis limestone

* No outcrops located

ST.LOUIS LIMESTONE

An outcrop of the St.Louis limestone was located along the stream in the NE.¼ NW.¼ SW.¼ sec. 22.

Fig.1 St. Louis Limestone

The maximum dip is 32 degrees, although these blocks may have slumped. Beds which dip 22 degrees are positively in place and suggest a close proximity of a fault.

The St. Louis limestone was identified by its characteristic dark brownish gray color; fine grained, compact texture; absence of fossils, and dolomite content.

The thickness of the St. Louis formation is about 200 feet in this area. No older formation was located except the Clear Creek chert which will be discussed later. The Fredonia-St. Louis contact was not located, but the former outcrops less than one-eighth mile along the same stream.

FREDONIA LIMESTONE

The Fredonia limestone outcrops along the south bank of a stream NE.¼ SW.¼ sec. 22. The beds are medium to thin and dip northeastward at an angle of 20 degrees.

The Fredonia limestone was identified by its buff to brown color and by its coarsely crystalline to oolitic texture. It is locally fossiliferous.

T he thickness of the Fredonia formation in this area is about 200 feet. The Renault and Paint Creek formations which normally occur above the Fredonia were not identified in this area. A sandstone which appears to be Cypress was the next formation observed, although no contact was discovered. The absence of the New Design group and upper St. Genevive formation could be explained by a minor fault branching southeastward from the major fault which is south of the area.

CYPRESS SANDSTONE

The only outcrop identified as Cypress sandstone is in the stream bed in the SE.¼ NW.¼ NW.¼ sec. 22.

The sandstone is fine grained, thin bedded, and extremely difficult to identify. However, its stratigraphic position below the Golconda - Glen Dean limestone seem to warrant the correlation of it as the Cypress formation. The beds dip 22 degrees to the northeast. Well records indicate a thickness of seventy feet or more for this formation.

GOLCONDA - GLEN DEAN FORMATIONS

The Golconda - Glen Dean limestones will be discussed together because of the author's inability to locate and identify the Hardinsburg sandstone. Several outcrops of limestones were observed between the Cypress and Tar Springs sandstones. Two contacts between the Glen Dean and Tar Springs formations in the SW.¼ sec.15. (See Figure #2 on following page.) The contact appears to be separated by an unconformity.

The Golconda and Glen Dean limestones were identified by their grey to buff color , coarsely crystalline texture, shaley tendencies, and by their stratigraphic position.

Sink holes in the N.½ NW.¼ sec.22 are caused by groundwater erosion of the Glen Dean limestone.

The total thickness of the Golconda and Glen Dean formations is about 120 feet. The Glen Dean formation is overlain by the Tar Springs sandstone.

Fig. 2 Contact between Glen Dean limestone and Tar Springs sandstone (Hammer indicates contact.)

TAR SPRINGS SANDSTONE

The Tar Springs sandstone is a prominent bluff formed in the Alto Pass area. Outcrops were located in several locations along the ridge which is apparent on the topographic sheet in the SE.$\frac{1}{4}$ SW.$\frac{1}{4}$ sec.15.

This sandstone is distinctively massive and crossbedded. An excellent outcrop appears on the north side of the country road in the SW.$\frac{1}{4}$ of sec. 15. It is a thirty foot cliff face which is cross bedded, and contains hollow pits due to weathering. (See Figures #3 and #4). This represents the middle Tar Springs. It is buff color (but weathers reddish from iron stain), medium grained, and compact.

A shaley sandstone on the south side of the road in a stream cut can be correlated as the lower Tar Springs.

The Tar Springs formation dips 6 degrees northeast and appears to be at least eighty feet thick. It is overlain by the Vienna limestone which outcrops to the northeast in the same stream.

Fig. 3 Tar Springs Sandstone in the SW.¼ NE.¼ Sec. 15 Bedding Plane is horizontal; Cross bedding dips 20 degrees to right.

Fig. 4 Tar Springs Sandstone Thirty foot cliff caused by resistant sandstone in the NE.¼ NE.¼ SW.¼ Sec. 15

VIENNA LIMESTONE

Several outcrops of the Vienna formation were located. Two were in the stream bottoms: One in the S.½ NE.¼ NE¼ sec. 15. Other outcrops are located on the side of a hill in the N.½ SW.¼ sec. 15, where it is overlain by Tar Springs sandstone. A perfect contact was not discovered.

The limestone is distinguished by its dark grey color, fine grained texture, Crinoid fossils and proximity of variegated shales. The beds conform to the regional dip of 6 degrees northeast and are only twenty to thirty feet thick.

The Vienna formation is over lain by the Waltersburg sandstone.

WALTERSBURG SANDSTONE

Although the Waltersburg formation is shaley and thin, it outcrops extensively in the area. A road cut along route 127 in the NW.¼ of NE.¼ of sec. 22 exposes a thin bedded sandstone and laminated shale which can be correlated as Waltersburg. Other outcrops are along route 127 in the NW.¼ SE.¼ sec.15 and in the stream bed at the center of that section.

The Waltersburg is recognized by its fracture into irregular blocks, and by its shaley characteristics. It is fine grained, thin bedded and compact. The The beds dip three to six degrees to the northeast and are from thirty to fifty feet thick.

The Waltersburg formation is overlain by the Menard limestone.

MENARD LIMESTONE

The Menard limestone is the most distinctive limestone of the Chester series in the area. Outcrops are located at a road cut on Route 127 in the NW.¼ NW.¼ sec.15. Measurements of the outcrop are as follows:

Limestone, grey, coarsely crystalline, fossiliferous	2'0"
Shale, green, calc, very fossiliferous	8"
Limestone, grey, compact	4'0"
Shale, green, calcareous	8"
Limestone, grey to buff, micro fossils	2'0"

Other excellent outcrops are located on the side of the bluff east of the North-South road between Alto Pass and Route 127 in the NE.¼ NW.¼ sec. 15, and in a stream cut east of Route 127 in NW.¼ NW.¼ sec.15. (See Figures #5 and #6)

Shale interbedding is present in most of the outcrops. It is green to black, calcareous and highly fossiliferous. Lenses of solid fossils which were well preserved and apparently not transported any great distance were located. Bryozoa, including Archimedes, Brachypods including spirifers, and crinoids were especially abundant.

The Menard formation is almost one hundred feet thick in this area. It dips gently to the north, and is overlain by the Palestine sandstone.

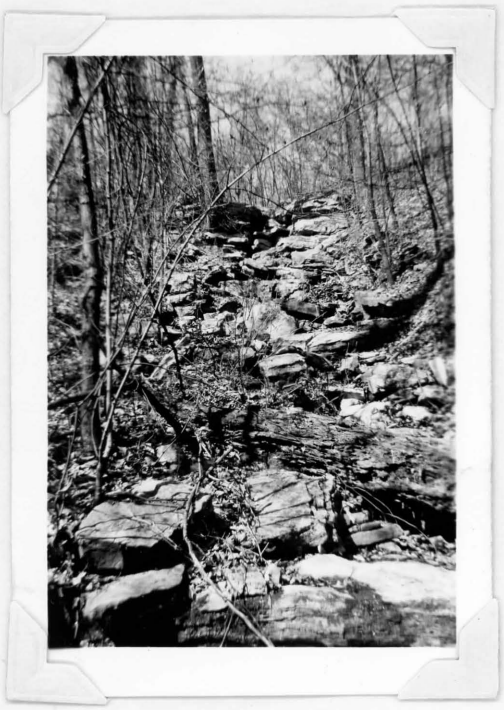


Fig. 5 Menard Limestone in the SE.¼ NE.¼ NW.¼ Sec. 15 showing typical stream drainage.

Fig. 6 Menard Limestone in the SE.¼ NE.¼ NW.¼ Sec. 15 Beds dip 7 degrees northeast.

PALESTINE SANDSTONE

One outcrop which can be correlated as Palestine sandstone was located in the valley of an intermittent stream south of Alto Pass in the NE.¼ NW.¼ sec. 15. (See Figure #7).

The sandstone is fine grained, thin bedded, shaley, and locally ripple marked. The beds dip slightly northeastward, conforming to regional dip. Their total thickness is about thirty feet.

The Palestine formation is overlain by the Clore limestone.

Fig. 7 Palestine Sandstone and Shale

CLORE FORMATION

One outcrop which can be correlated as the Clore limestone and calcareous shale was observed in the NW.¼ NW.¼ NE.¼ sec.15 just south of Alto Pass.

Fig. 8 Clore Limestone and Shale

The limestone is grey , argillaceous and fine grained; it grades upward into a shale and shaley sandstone which may represent the lower Degonia.

The thickness of the Clore formation is about thirty feet in this area. It is over lain conformably by the Degonia sandstone.

DEGONIA SANDSTONE

The Degonia sandstone forms the "pass" of Alto Pass. It is a prominent ridge former along the entire northern and eastern boundaries of this area.

Outcrops were observed at Alto Pass, at a road cut on Route 127 in the SW.$\frac{1}{4}$ SW.$\frac{1}{4}$ SW.$\frac{1}{4}$ sec. 10, and at numerous points along ridge southwest of road which trends northwest - southeast through Alto Pass.

Fig. 9 Degonia Sandstone at Alto Pass.

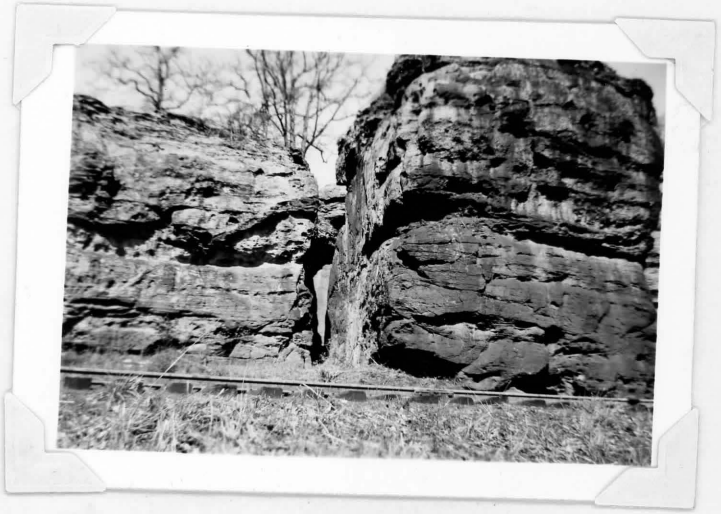


Fig. 10 Degonia Sandstone at Alto Pass showing vertical joints and rounded horizontal joints.

The sandstone is buff colored, massive, irregularly bedded, and compact to quartzitic at top. It grades downward to a thinner bedded, shaley sandstone. Vertical joints tend to isolate huge blocks. Horizontal joints are curved.

The Degonia formation is at least seventy feet thick in this area and appears to be the youngest bed rock. If the Kincaid lime stone is present, it is in isolated localities and would necessarily occur along the northeastern boundary. Small slump blocks, which were found high among Degonia outcrops along the northeastern ridge, probably represent remnants of the Kincaid formation. A large block of Lick Creek sandstone is balanced on the Degonia Ridge with no Kincaid between them. Its occurence will be discussed in a later section.

PLEISTOCENE SYSTEM

The southern most boundary of Illinoian glaciation is immediately north of Union county. The only evidence of pleistocene deposition in this area is of eolian origin. Loess deposits attain a thickness of thirty feet in some localities. The flood plane in the southwestern corner of the area is probably recent alluvium deposition. It affords poor soil for agriculture. Orchards, however, seem to thrive on the sandy soil obtained from the weathering of Pennsylvanian sandstones and shales.

RELATED FORMATION

Two other formations worthy of mention here are the Clear Creek chert of the middle Devonian and the Lick Creek sandstone of the Pennsylvanian system.

The Clear Creek chert was investigated at an outcrop South of the area to establish the position of a major fault. The outcrop appears on a bluff facing north in the NW.$\frac{1}{4}$ NE.$\frac{1}{4}$ sec. 28.

The Clear Creek formation consists of alternating layers of buff to grey limestone and white chert. Fossils are locally abundant. This formation must be at least 350 feet thick. The beds of intermittent streams from Bald Knob are composed mainly of chert.

Fig. 11 Author viewing chert in streambed on east flank of Bald Knob.

The closest outcrop, about one-half mile northeast, is St. Louis limestone. Approximately 1200 feet of formations are missing between the two.

The second related formation has more scenic than geological value. A rounded block of Lick Creek sandstone lies unconformably upon a ridge of Degonia sandstone along the south of the road in the NW.$\frac{1}{4}$ NE.$\frac{1}{4}$ sec.15.

Fig. 12 Lick Creek block balanced on Degonia ridge.

The Lick Creek sandstone is brown, massive and coarse grained. It can be easily identified by its conglomeratic pebbles of quartz.

The Kincaid limestone was probably thin and eroded away at this location leaving the more resistant Lick Creek resting directly on the Degonia. It is inconceivable that the block was moved any great distance because of its size and weight, and the lack of glaciation in the area.

STRUCTURE

The structure of southern Illinois is extremely complicated. The Illinois basin is formed like a spoon with no handle. The bed rock outcrops along the rim of the basin. Alto Pass and vicinity are located on this rim, thus affording outcrops of the complete Chester series. Regional dip is from six to seven degrees northeast toward the center of the basin.

In the southern part of the area (NW.$\frac{1}{4}$ sec.22) the dip of the beds increases to thirty degrees; to the southwest 1200 to 1500 feet of formations are missing between the St. Louis limestone and the Clear Creek chert. The only explanation of this is a major fault along the strike of the bedrock.'

About 300 feet of formations of the Paint Creek, Renault, and St. Genevive age were not located in the area and may be faulted out by a minor fault.'

No intricate folding is apparent in this area, and no major unconformities were located. However, many of the Chester formations are separated by unconformities.

INTERPRETATION OF GEOLOGIC HISTORY

Evidences of marine deposition in this area are complete through the Mississippian period. At the end of this period there was a long interval of time in which no deposition took place. During this interval uplift and some warping occurred causing the faults in this area.

The Ozark ranges to the south west were active over a long period of time, but were probably high enough to furnish much of the Mississippian sediments as the Illinois basin gradually sank to accommodate them. This would infer that the local source rocks for the Mississippian sediments were pre-Cambrian rocks

a person infers; evidence indicates

' See Structure section page - number?

which were uplifted to the southwest in the area now called the Ozark Mountains.

Erosion is probably in a mature stage. The area is well drained, but the topography is quite rough. The lack of Pleistocene glaciation causes this area to have a much more varied topography than north and central Illinois.

ECONOMIC RESOURCES

Bed rock in this area offers little in the way of economical resources. Some building stones are obtained from Mississippian formations, but to no great extent. Coal, ceramic clays, and agricultural lime come from the Pennsylvanian formations which are absent in the area. Gravels in the area are too cherty for concrete aggregate, but due to their resistant qualities make excellent road ballast. The chert is harmful to automobile tires, however, because of its sharp conchoidal fracture.

All of the Mississippian formations which produce oil in the Illinois basin are present in this area, but because of their outcropping attitude they can form no major trap. Even a local structural trap in the area is highly improbable. Hydrocarbons have been located in wells which are southwest of the fault.[1] It is the opinion of the author that any producing wells would either occur in a local structural trap north of the area or southwest of the major fault, but none in the area are studied.

1 J. Marvin Weller
Geology and Oil Possibilities of Extreme Southern Illinois

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Weller, J. Marvin

Geology and Oil Possibilities of Extreme Southern Illinois

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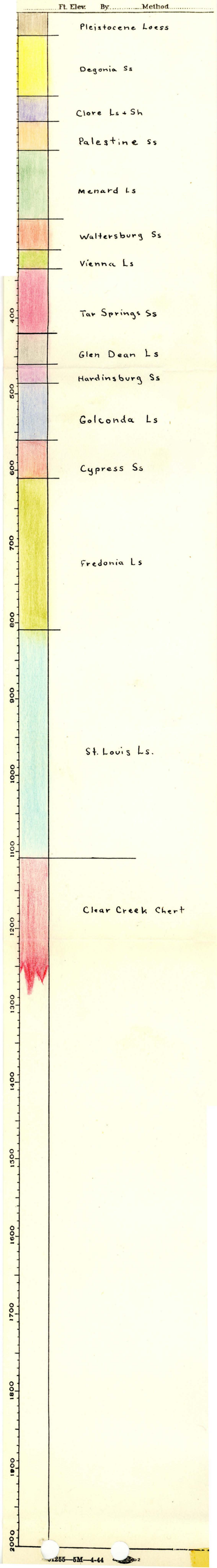

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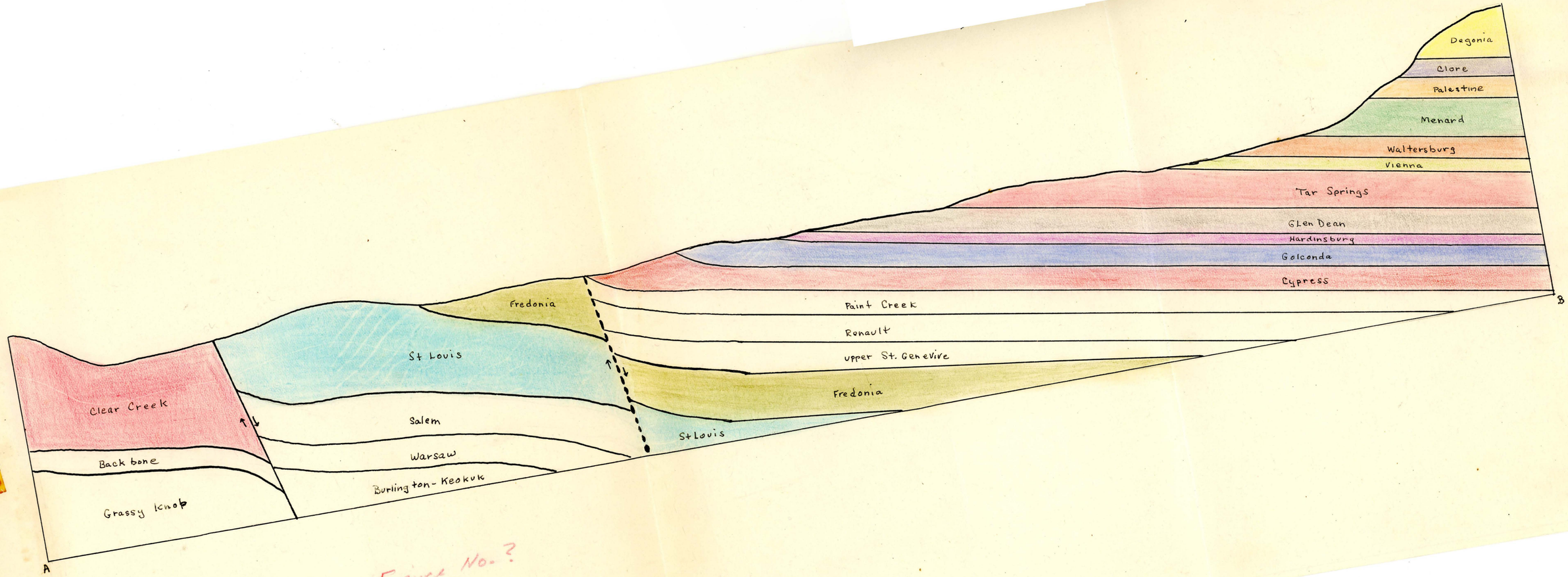

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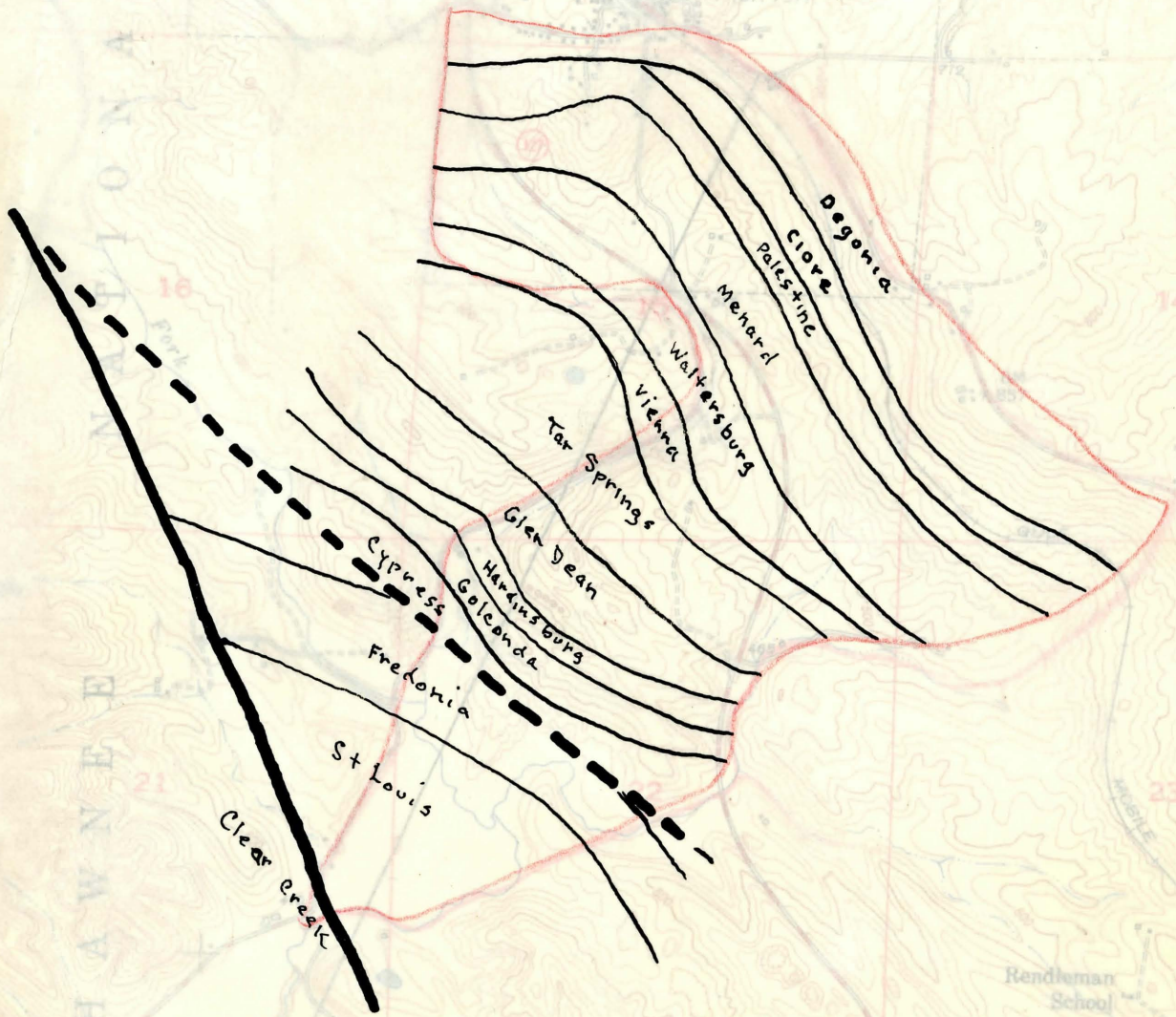
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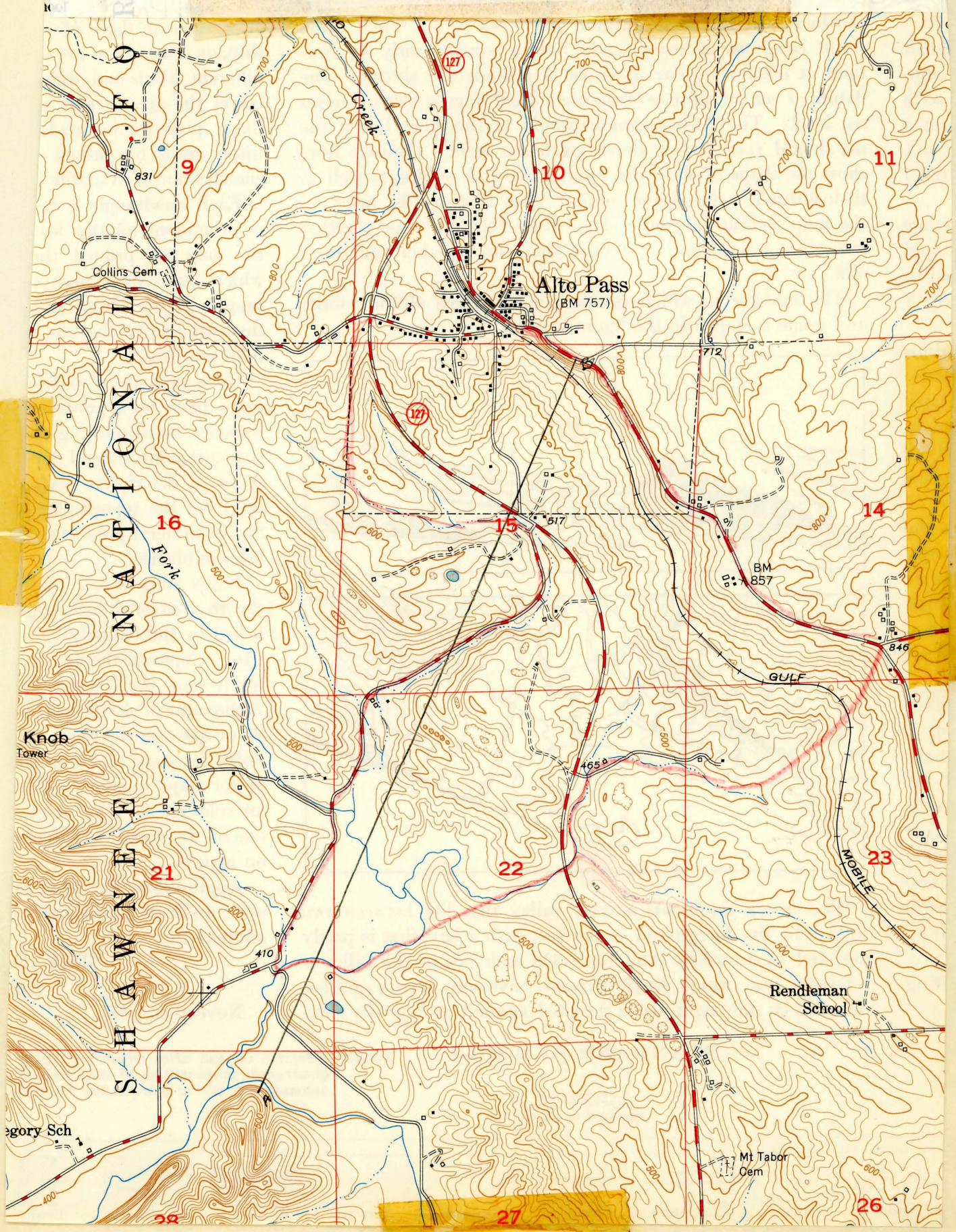
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