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January 30, 1972

James L. Calver
State Geologist
Division of Mineral Resources
Department of Conservation and Economic Development
Box 3667
Charlottesville, Virginia 22903

Dear Dr. Calver:

In reference to your letter of January 10, please place my paleocurrent data for the Keyser Formation in your library holdings on Virginia geology. At some future date, I will try to supply the additional information which you require for publication.

Sincerely yours,

Warren Montgomery

Warren Montgomery

VIRGINIA DIVISION OF
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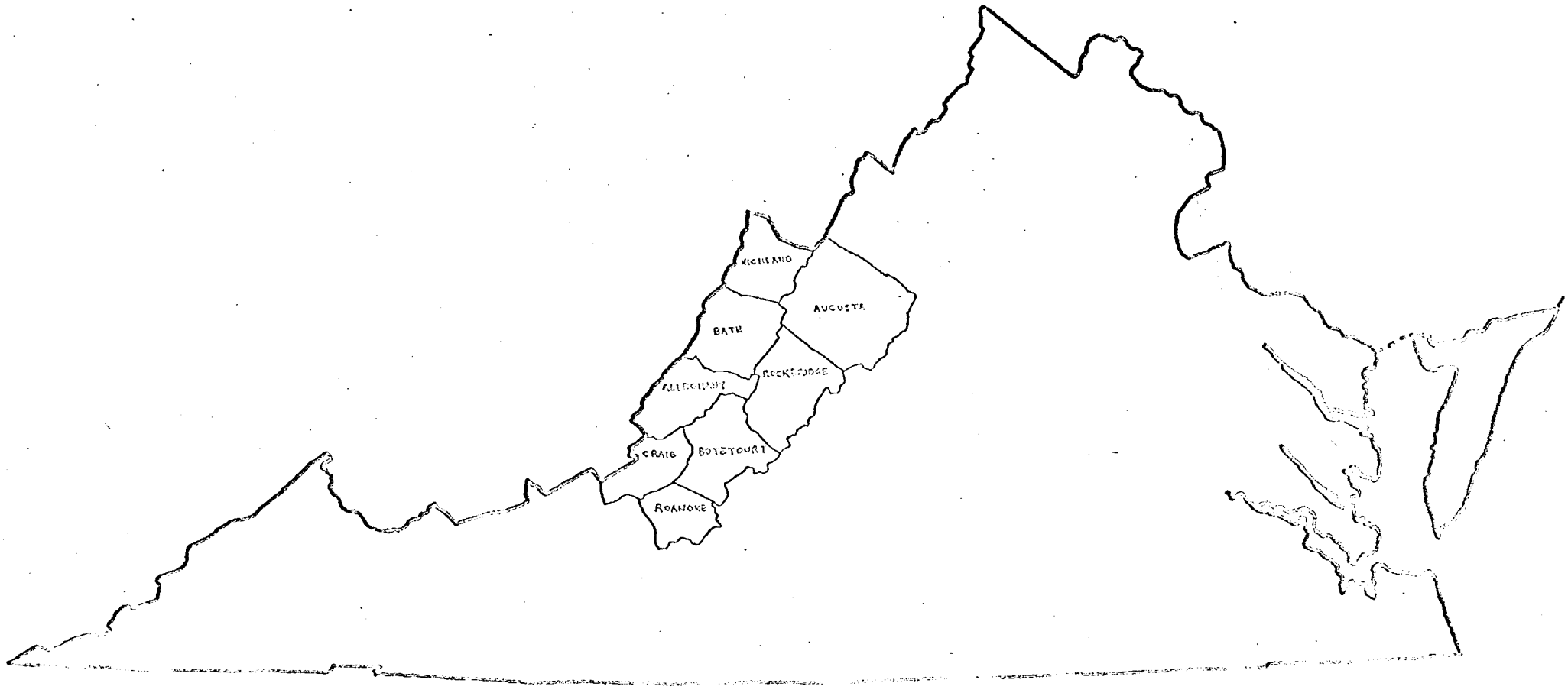
MINERAL RESOURCES



Area of Investigation

INTRODUCTION

During the period of tectonic quiescence that followed the reduction of the Taconic mountains and preceded the Acadian Orogeny, the Appalachian Geosyncline was the site of predominantly carbonate deposition. In late Silurian and early Devonian time, deeper water conditions moved northeastward up the geosyncline, causing the deposition of a sequence of rocks—mostly limestones—which can be interpreted to reveal the environmental trends of the transgression. At the beginning of late Silurian time, the influx of clastics into western Virginia recorded by the Wills Creek sandstone (fig. 1) gave way to supratidal to paralic conditions over broad areas of the geosyncline. This stage is marked by deposition of the Tonoloway limestone, a thin-bedded, dolomitic, mudcracked limestone containing very few fossils. A change in environment toward more normal marine conditions produced the overlying Keyser formation, mostly fossiliferous limestones but containing in western Virginia a sand member known as the Clifton Forge sandstone. This unit is the subject of the present study. The Keyser formation is the last unit recognized as Silurian in western Virginia. It is followed by the Coeymans limestone, which in western Virginia is a pure, coarsely crystalline, encrinal limestone which seems to be formed of the debris of extensive crinoid "meadows." Above the Coeymans is the New Scotland formation, typically limestone to the north but containing sandy layers in Virginia and grading to a limy sandstone (Healing Springs formation) in

the southern part of the project area. Above that is the Licking Creek limestone, containing much chert in nodular layers in the lower part. The Licking Creek is suceeded by the Oriskany sandstone, a thin but uniformly present bed of orthoquartzite, and the Romney shale, which is believed to represent the beginning phases of the Acadian Orogeny.

The Keyser, Coeymans, New Scotland, and Licking Creek formations are generally referred to as the Helderberg group, and the sea's advance up the Appalachian geosyncline that they express will be here referred to as the Helderberg transgression. The environments indicated by the lithologies of these four units probably all existed contemporaneously in one part or another of the geosyncline; the map units are probably in part temporally equivalent. This facies relation has been recently demonstrated by work in the Helderberg rocks of New York state (Laporte, 1966). It is believed by Laporte and other workers in that area that the entire Helderberg sequence indicates a gradual but fairly regular transgression and deepening of the sea from southwest to northeast (James W. Head, personal communication). During the Helderberg transgression, local and relatively short-lived influxes of clastics into the sea occurred. In western Virginia, the Clifton Forge sandstone and the sand facies of the New Scotland formation (Healing Springs) seem to represent such point influxes. Others occur farther north. These sands in the predominantly carbonate rock sequence do not represent real breaks in the trend toward transgressive, deepening conditions

in the geosyncline but are indicative of increased clastic supply and transporting competence. Sands and some lutites were "dumped" into the basin, temporarily masking carbonate deposition at their areas of influx.

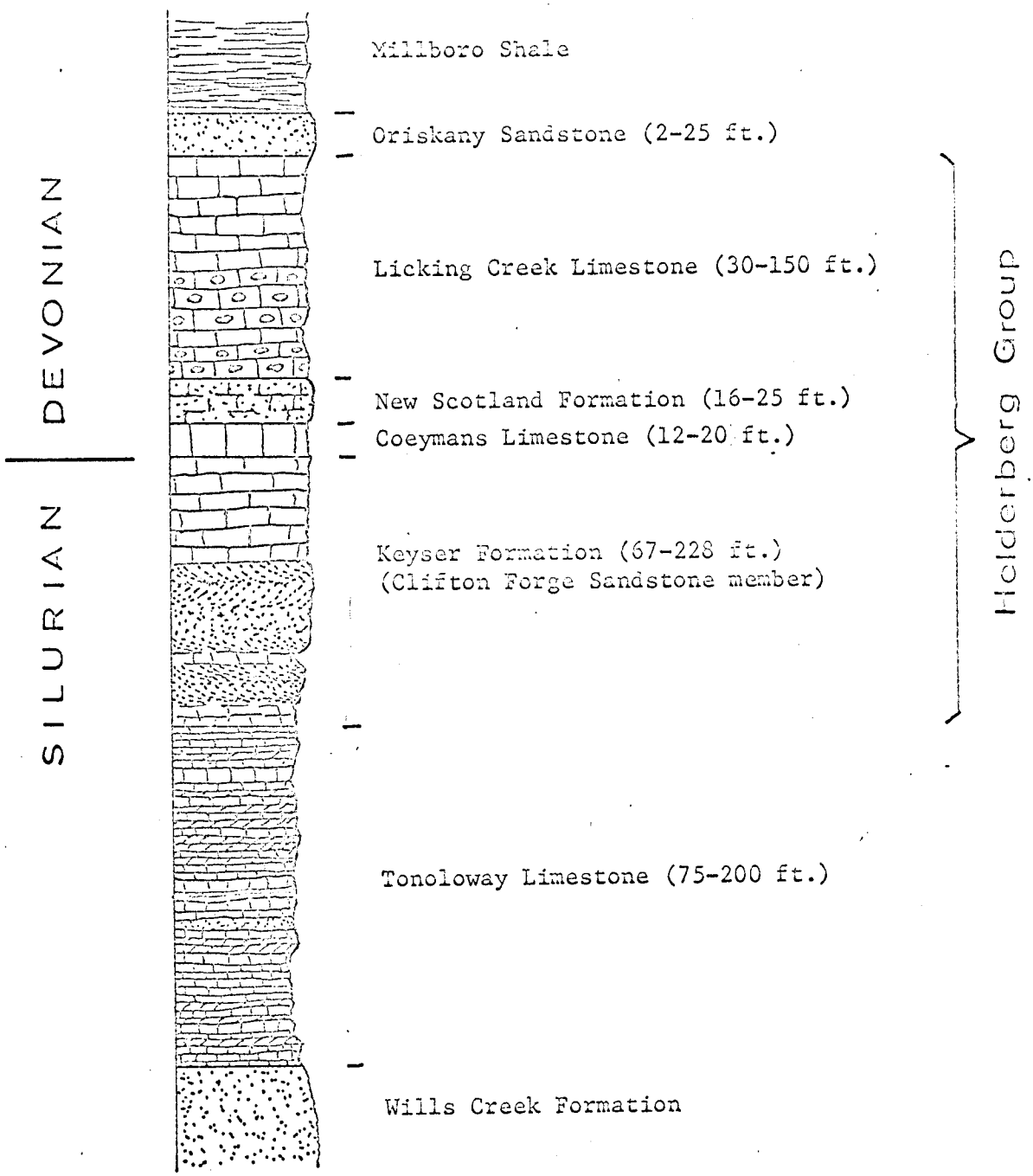


Figure 1
Stratigraphy of the Upper Silurian and
Lower Devonian in Western Virginia

THE CLIFTON FORGE SANDSTONE

Distribution

Where the Keyser formation outcrops in western Virginia (Fig. 2), the Clifton Forge sandstone member is found in Augusta, Bath, Rockbridge, Alleghany, Botetourt, Craig, and Roanoke counties. Clifton Forge sands are not present in Keyser limestones of Highland County. The presence and nature of Keyser sediments to the southwest are uncertain. The Keyser as a whole thickens to the northwest (Fig. 4), but the Clifton Forge sandstone forms a wedge within the Keyser, thinning and interfingering with the limestones toward the north and probably to the northwest and thickening to the east and south (Fig. 5). The Keyser is present in northwest Augusta, Rockbridge, Botetourt, and Roanoke counties, but southeast of the central portions of these counties it is absent, lost through uplift and erosion. It is thought that the margin of the upper Silurian geosyncline existed in the general vicinity of the Blue Ridge Mountains and that the Keyser went to sand and pinched out as the margin was approached.

Profiles depicted in Figures 7 and 8 demonstrate the spatial relations between Keyser limestones and the Clifton Forge sandstone member. These profiles and the isopach maps (Figs. 4 and 5) are constructed from data previously presented by the author (Montgomery, 1967). — unpublished thesis... W&L univ.

Fig. 2
KEYSER OUTCROP PATTERN and STATION LOCATIONS

1. Little Mountain
2. Monterey
3. McDowell
4. Williamsville
5. Bolar
6. Starr Chapel
7. Back Creek Mountain
8. Dry Run
9. Chestnut Ridge
10. Craigsville
11. Hot Springs
12. Panther Gap
13. Bells Valley
14. Wilson Bridge
15. Gathright Dam
16. Healing Springs
17. Horeb Church
18. Route 42 Quarry
19. Fore Mountain
20. Island Ford
21. Iron Gate
22. Prices Bluff
23. Robinson Store
24. Eagle Rock
25. Mill Creek
26. Barbours Creek
27. Johns Creek Gorge
28. Newcastle
29. Sinking Creek Mtn.
30. Catawba Mountain
31. Hanging Rock

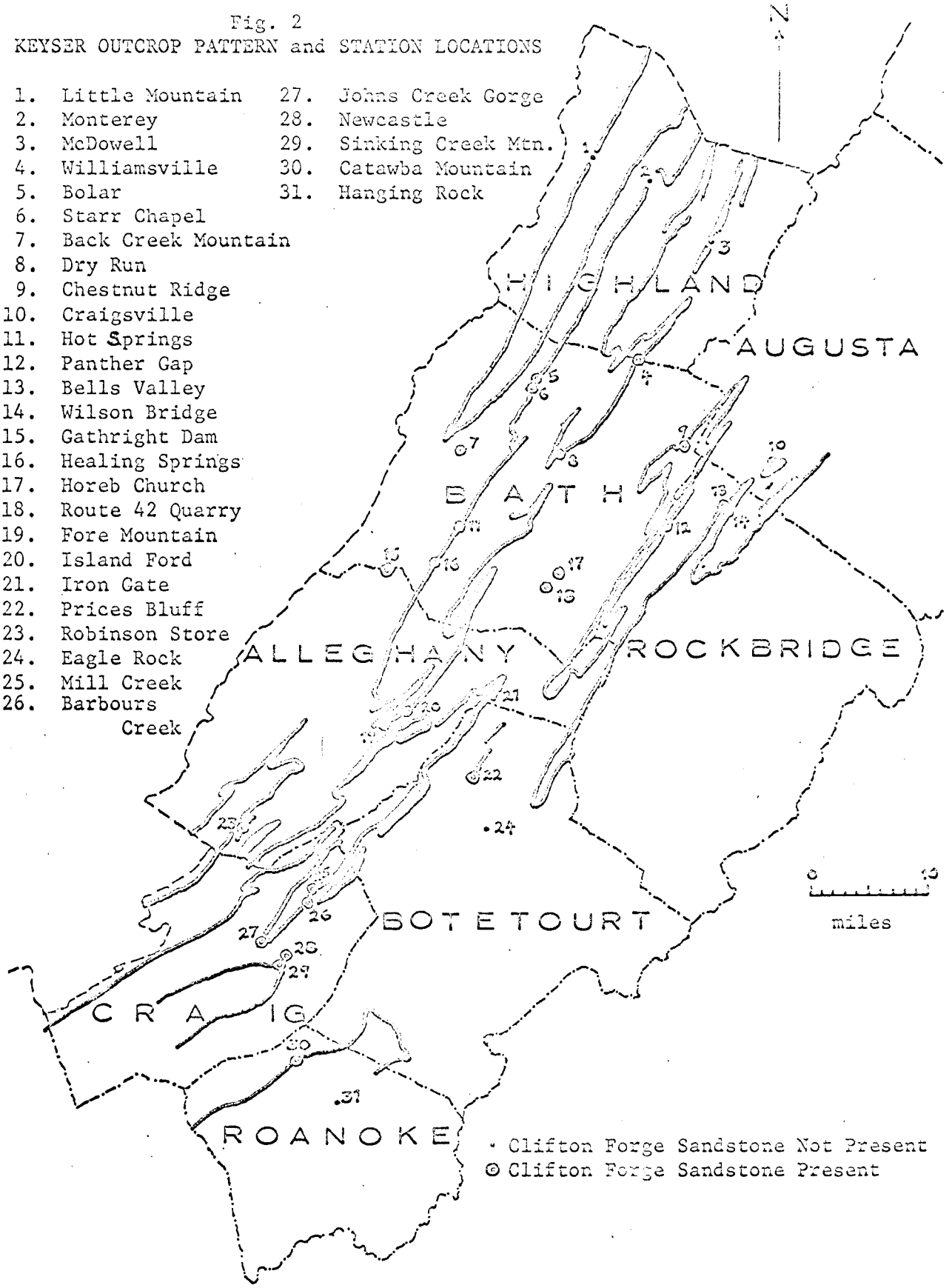


Fig. 4

ISOPACH MAP OF THE KEYSER FORMATION

(from Montgomery, 1967)

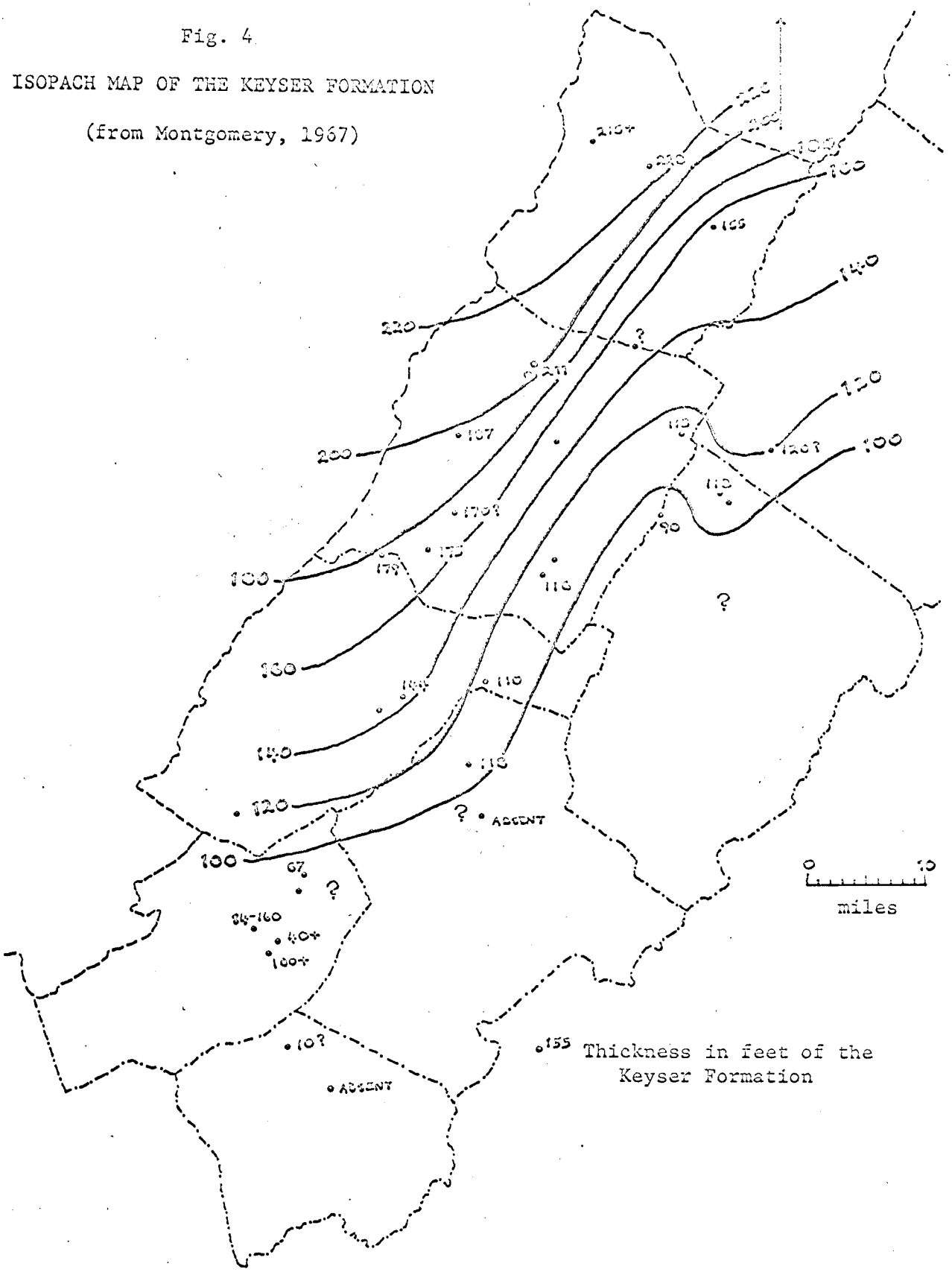


Fig. 5

ISOPACH MAP OF THE CLIFTON FORGE SANDSTONE

(from Montgomery, 1967)

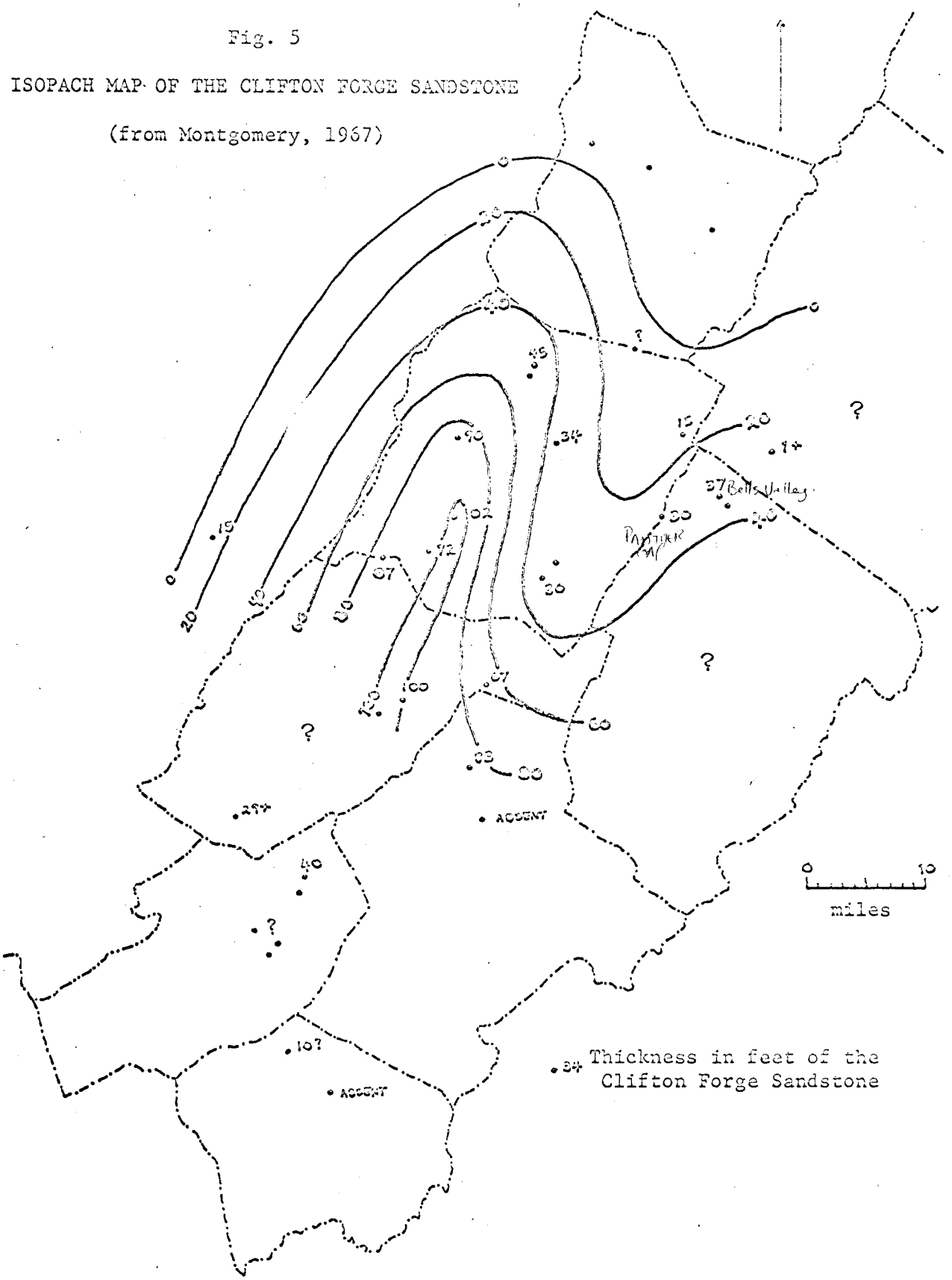
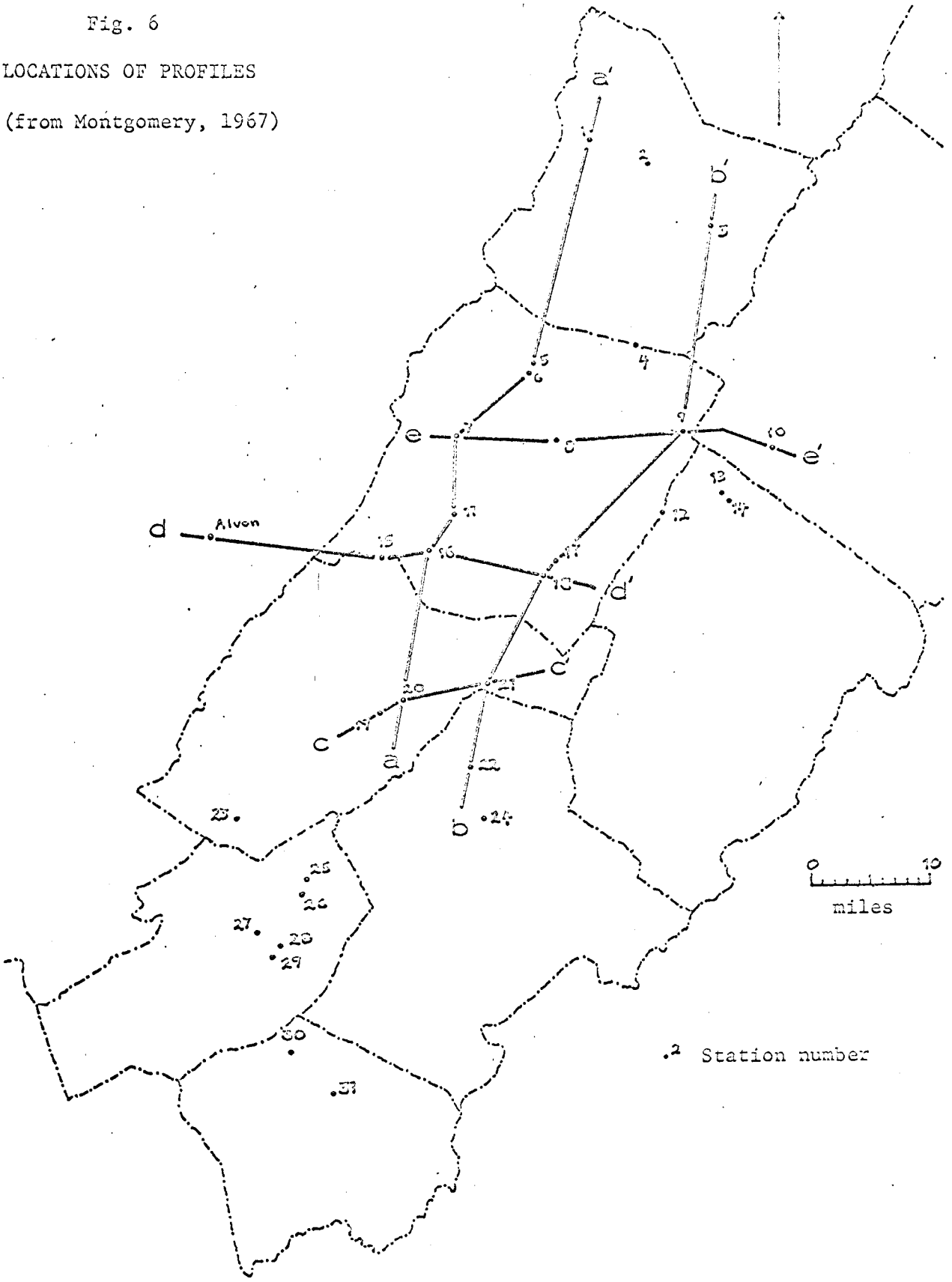


Fig. 6

LOCATIONS OF PROFILES

(from Montgomery, 1967)



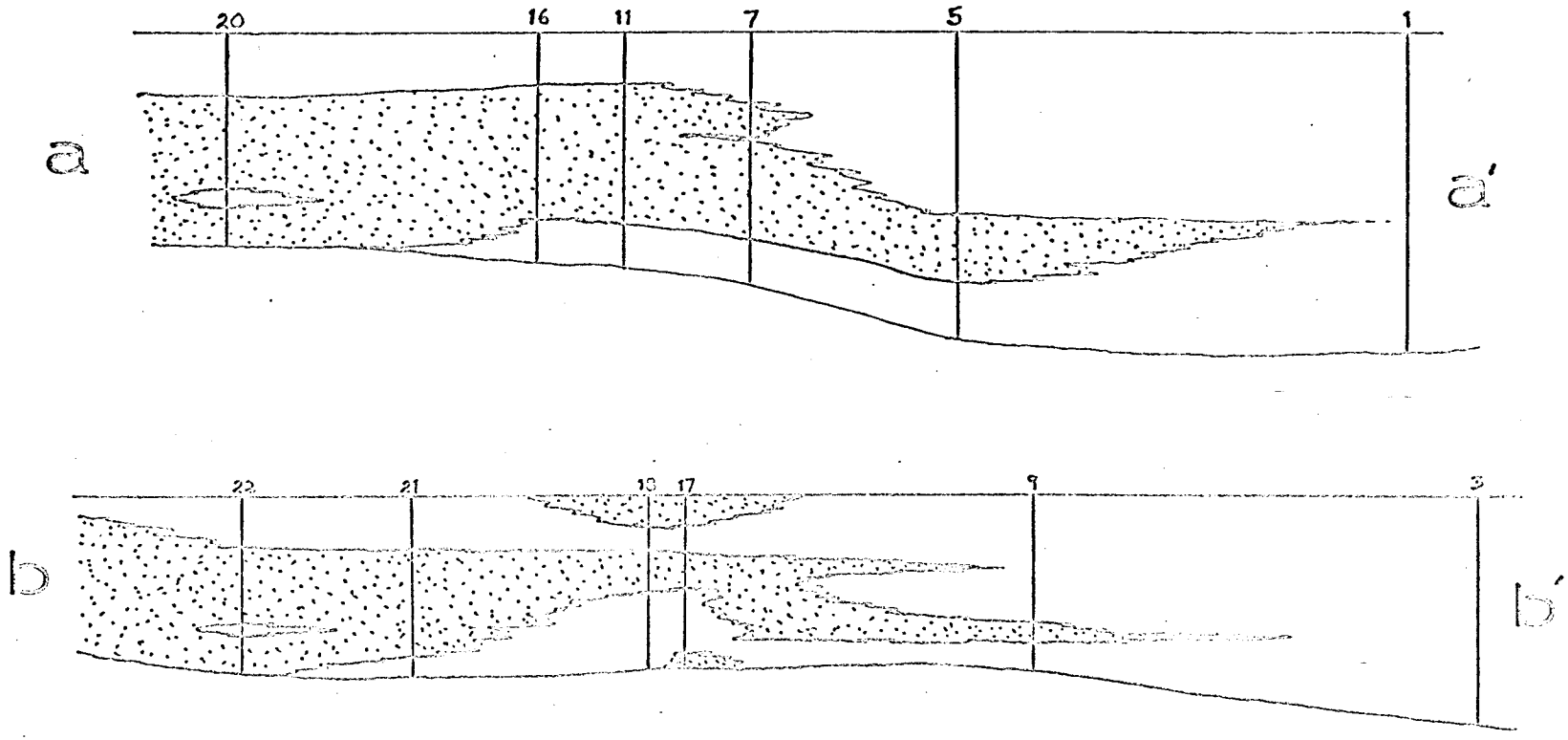


Fig. 7

PROFILES OF THE KEYSER FORMATION

(from Montgomery, 1967)

Note: sand portions are stipled. Carbonate facies are blank. Upper bounding line represents the Keyser-Coeymans contact. Lower bounding line represents the Tonoloway-Keyser contact.

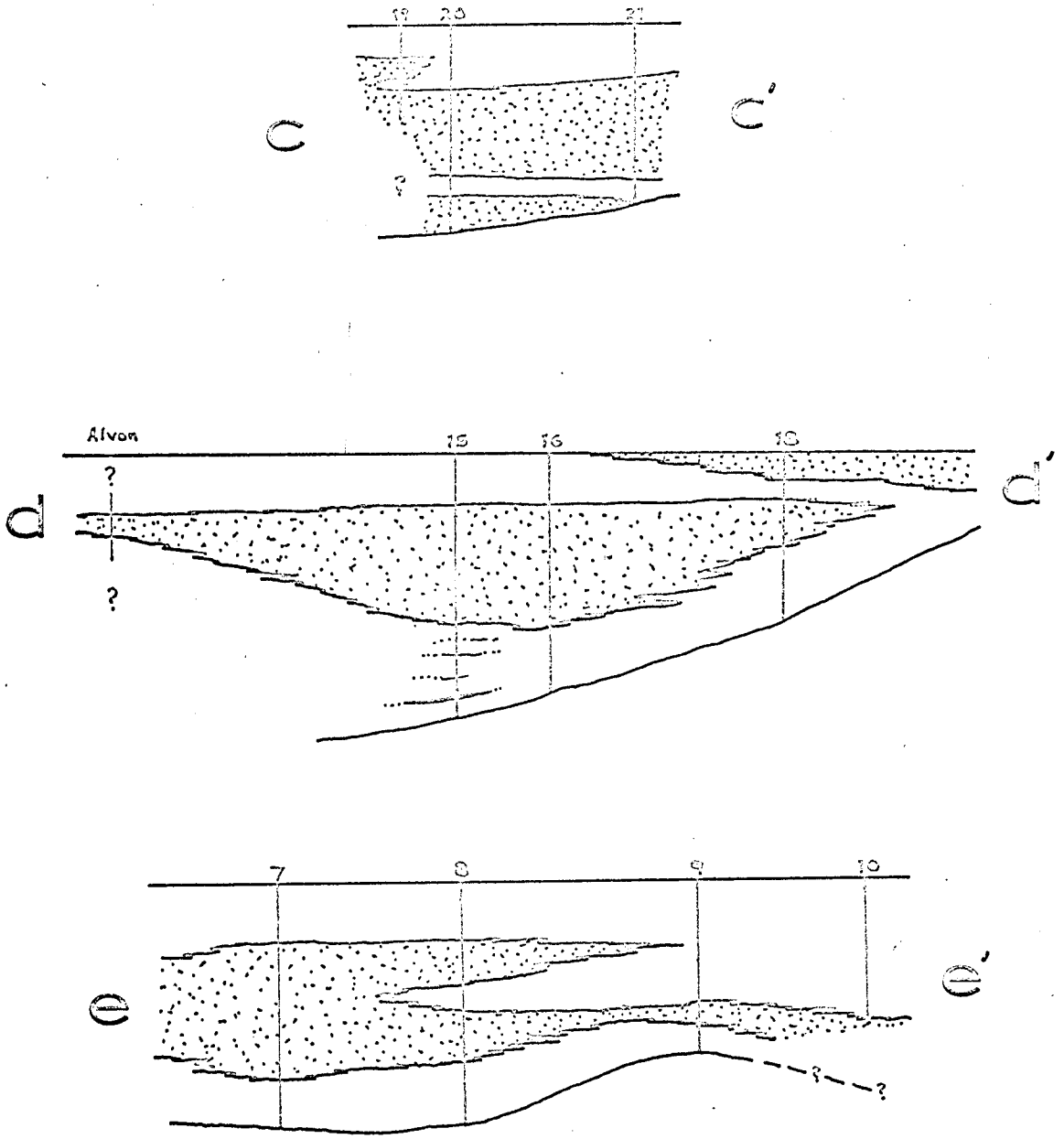


Fig. 8

PROFILES OF THE KEYSER FORMATION

(from Montgomery, 1967)

Note: Sand portions are stipled. Carbonate facies are blank. Upper bounding lines represent the Keyser-Coeymans contact. Lower bounding lines represent the Tonoloway-Keyser contact.

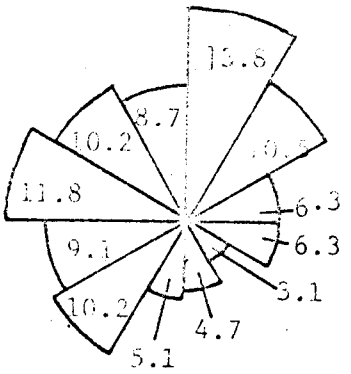


Fig. 11

Grand Mean

of

Total Readings (254)

(Note: in Figs. 11 and 12 only, 2 mm. = 1 %)

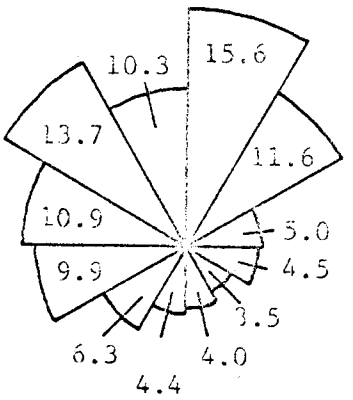


Fig. 12

Station Average

for

10 Stations

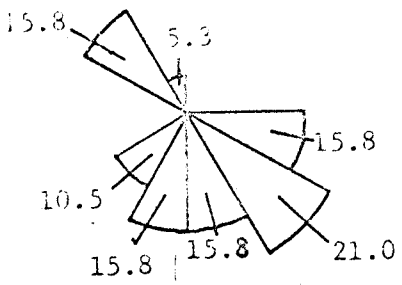


Fig. 13

Station No. 8

Dry Run

19 Readings

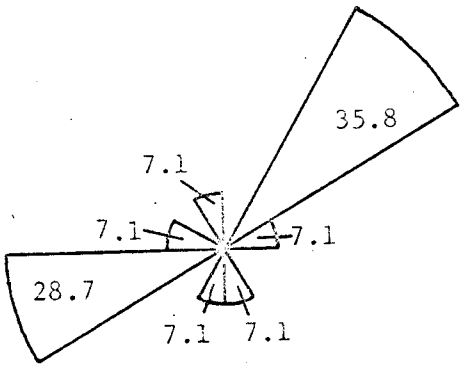


Fig. 14

Station No. 13

Bells Valley

14 Readings

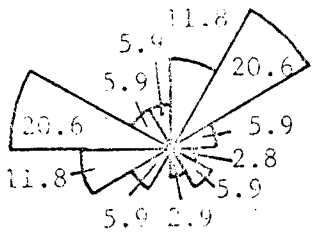


Fig. 15

Station No. 15

Gathright Dam

34 Readings

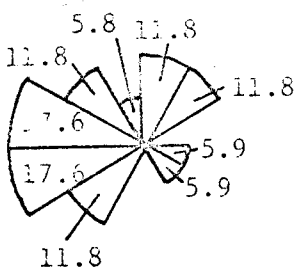


Fig. 16

Station No. 15

Gathright Dam

Bottom 17 Readings

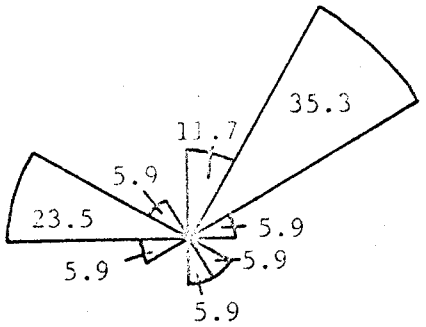


Fig. 17

Station No. 15

Gathright Dam

Top 17 Readings

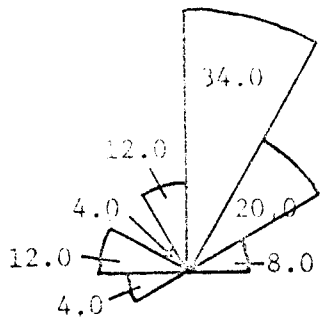


Fig. 18

Station No. 18

Route 42 Quarry

50 Readings

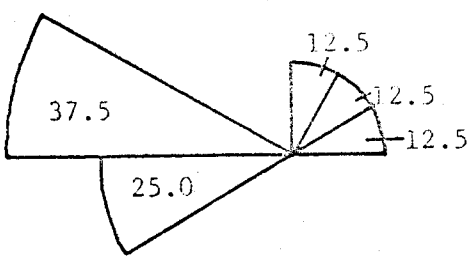


Fig. 19

Station No. 18

Route 42 Quarry

Cut-and-Fill Structures

(16 Readings)

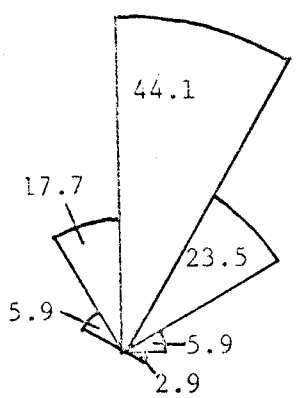


Fig. 20

Station No. 18

Route 42 Quarry

Tabular Cross-Bedding

(34 Readings)

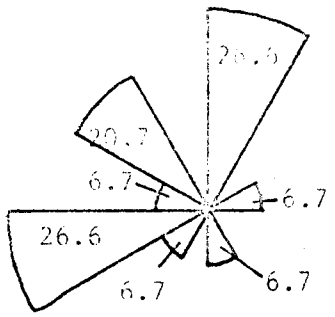


Fig.21

Station No. 19

Fore Mountain

15 Readings

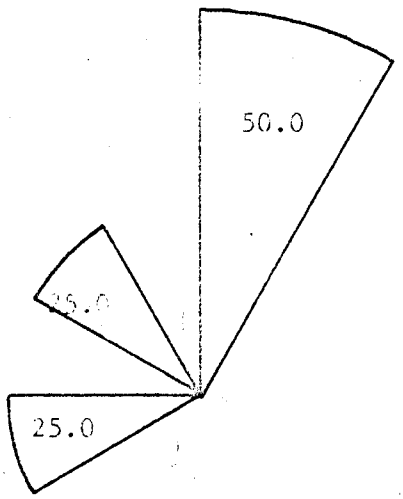


Fig. 22

Station No. 19

Fore Mountain

Bottom 8 Readings

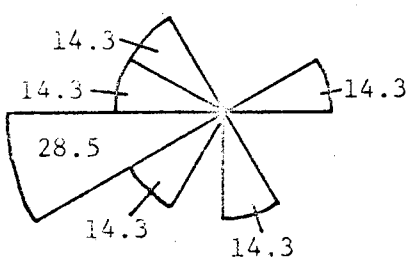


Fig. 23

Station No. 19

Fore Mountain

Top 7 Readings

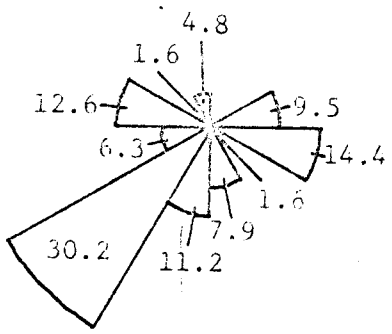


Fig. 24

Station No. 20

Island Ford

63 Readings

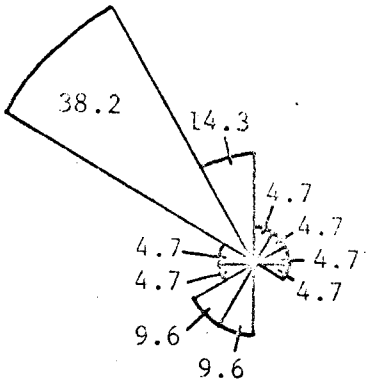


Fig. 25

Station No. 22

Prices Bluff

21 Readings

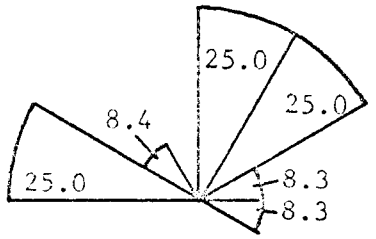


Fig. 26

Station No. 23

Robinson Store

12 Readings

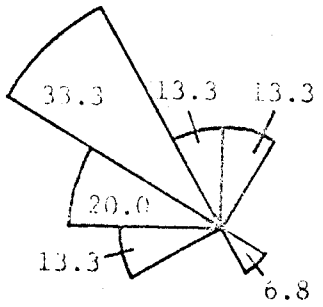


Fig. 27

Station No. 26

Barbours Creek

15 Readings

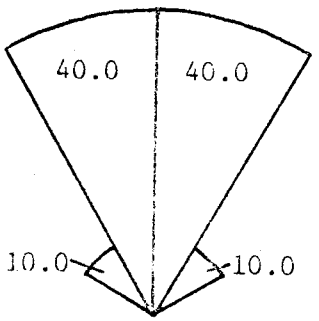
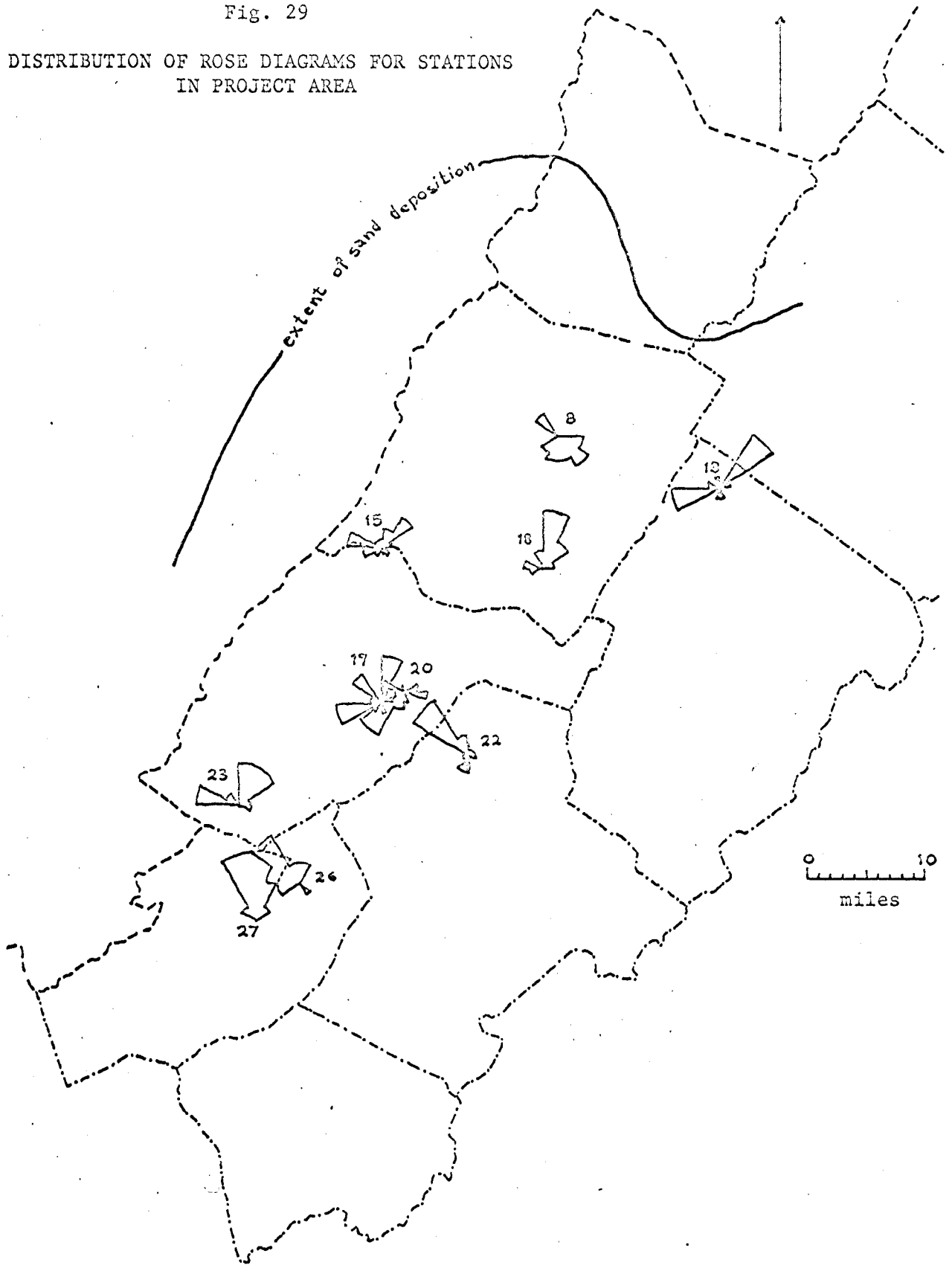


Fig. 28

Station No. 27

Johns Creek Gorge

10 Readings

Fig. 29

DISTRIBUTION OF ROSE DIAGRAMS FOR STATIONS IN PROJECT AREA