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DÉCOLLEMENT IN THE SOUTHERN ALLEGHENY PLATEAU OF PENNSYLVANIA

BY

H. A. POHN

AND

T.L. PURDY

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ABSTRACT

Recent field investigations in the Allegheny Plateau north of Williamsport, Pennsylvania have shown the presence of both southward dipping, low-angle thrust faults translated to the north and northward dipping back or antithectic thrusts translated to the south at the leading (north) edge of Barclay syncline. The presence of these thrusts, along with reported anomalous dips along the leading edge of the next syncline to the south (the Bernice or Barbours syncline) may indicate that the Allegheny Plateau of Pennsylvania is underlain by master décollement and that this décollement gives rise to a series of splay thrusts.

In some cases such as the Barclay syncline, the combination of these forward and back thrust faults may serve as fracture porosity traps.

INTRODUCTION

Field investigations in Pennsylvania in the Ralston, Grover, and Leroy 7½-minute quadrangles (Fig. 1) have shown that a series of anomalously steeply dipping beds are present along the northern limb of the Barclay syncline (name from Fettke, 1954) in beds of Upper Devonian age. Although the normal dip of the beds along the front of the syncline varies from thirteen to twenty degrees, dips up to eighty degrees are present. Woodrow (1968) failed to explain these anomalous dips, although he placed a normal fault downdropped to the north, one to two kilometers to the north of the zone of anomalous dips. A thrust fault or a series of thrust faults provides a more consistant explanation for the disparate nature of the dips.

FIELD INVESTIGATIONS

Field investigations were conducted in May and June of 1979 in the Leroy, Grover and Ralston quadrangles in order to gain a better understanding of the deformation along the northern limb of the syncline. In the Ralston 7½-minute quadrangle at a cut along the abandoned Penn Central railroad tracks 0.3 km east of Dogtown (D, Fig. 1), we found the first evidence of faulting. The fault (Fig. 2) is a low angle thrust of unknown magnitude of offset to the north which evolves into a bedding plane thrust at the face of the railroad cut. In a road cut 0.7 km southwest of Leolyn (L, Fig. 1) and about 2.3 km east-northeast of the locality near Dogtown, dips change from 70°S through vertical to 20° south within a horizontal distance of 0.15 km; this area lies on strike with the projection of the fault observed in the first exposure. Continuing east-northeastward along strike to the Leroy 7½-minute quadrangle, there are a series of anomalously dipping beds in intermittant outcrops in a roadcut 1.7 km south of Leroy (LY, Fig. 1). All of these exposures south of Lycoming and Towanda Creeks (*LC* and *TC*, respectively Fig. 1) appear to be related and probably represent a thrust fault or group of thrust faults with the upper plate translated northward.

North of Lycoming and Towanda Creeks there is another series of anomalous dips along both banks of Roaring Branch Creek (*RBC*, Fig. 1, Ralston 7½-minute quadrangle). North of the town of Roaring Branch (RB, Fig. 1) along West Mill Creek (*WMC*, Fig. 1) there are as many as eight small (10cm - 10m displacement) thrust faults translated to the south (Fig. 3). Continuing along the strike of these faults to the north-northeast, there are numerous anomalous dips: 0.3 km northeast of Leolyn; along the north side of Towanda Creek (in the Leroy 7½-minute quadrangle); and according to Woodrow's map (1968), on the north side of Towanda Creek in both the Powell and Monroeton 7½-minute quadrangles. Finally, a thrust fault to the south (back thrust) with an apparent displacement of several meters is present to the southeast of the town of Towanda (T, Fig. 1) in a recent road cut along Highway 220.

The exposures north of Lycoming and Towanda Creeks also appear to be related and probably represent the continuation of the group of back thrusts to the south, first seen north of the town of Roaring Branch.

CONCLUSIONS

The presence of a series of thrusts and back thrusts between the Barclay syncline and the Towanda anticline (Fig. 4) should hardly be expected to be a unique situation and indeed Tom Berg, Pennsylvania Geological Survey (oral communication, 1979) has noted another group of anomalously dipping beds southeast of the town of Shunk (S, Fig. 1). This observation seems to indicate the presence of another group of thrusts along the front of the Bernice or Barbours Syncline (Fig. 1).

Although these may be isolated occurences of thrust faults, all of the intermediate-amplitude folds of the Allegheny Plateau, from Williamsport to the Cowanesque Syncline (Fig. 1) may be disrupted by similar structures. If pervasive thrust faulting has occured in this part of the Allegheny Plateau, a master décollement may be present at depth. In this structural model the observed faults would be splay and antithetic faults formed at the point of inflection between the anticlines and the adjacent synclines to the south. These types of faulting can lead to the formation of fracture porosity traps.

REFERENCES

Fettke, C. R., 1954, Structure-Contour maps of the Plateau region of north-central and western Pennsylvania, Pennsylvania Geological Survey Bulletin, G27, Plate 1, Northeast sheet.

Woodrow, D. L., 1968, Stratigraphy, Structure and Sedimentary Pattern in the Upper Devonian of Bradford County, Pennsylvania, Pennsylvania Topographic and General Geology Report, G54, 77p.

FIGURES

Figure 1 Location map of northern Pennsylvania showing major structures and areas discussed in text. D-Dogtown, L-Leolyn, LY-Leroy, *LC*-Lycoming Creek, *TC*-Towanda Creek, *RBC*-Roaring Branch Creek, RB-Roaring Branch (Town), *WMC*-West Mill Creek, T-Towanda, S-Shunk. Short dashed lines are the trace of the approximate expression of of anticlines and synclines, long dashed lines are the axial traces of synclines and continious lines are axial traces of anticlines.

Figure 2 View looking eastward of low angle thrust fault, displaced to the north. Thickest beds are approximately 10cm. Arrows indicate fault.

Figure 3 View looking westward of back or antithetic thrust fault evolving from a fold. Thickest beds are 20cm. Arrows indicate fault.

Figure 4 Schematic cross-section of Barclay syncline and a probably representation of the Wilmot anticline and the Bernice or Barbours syncline. Considerable vertical exageration.

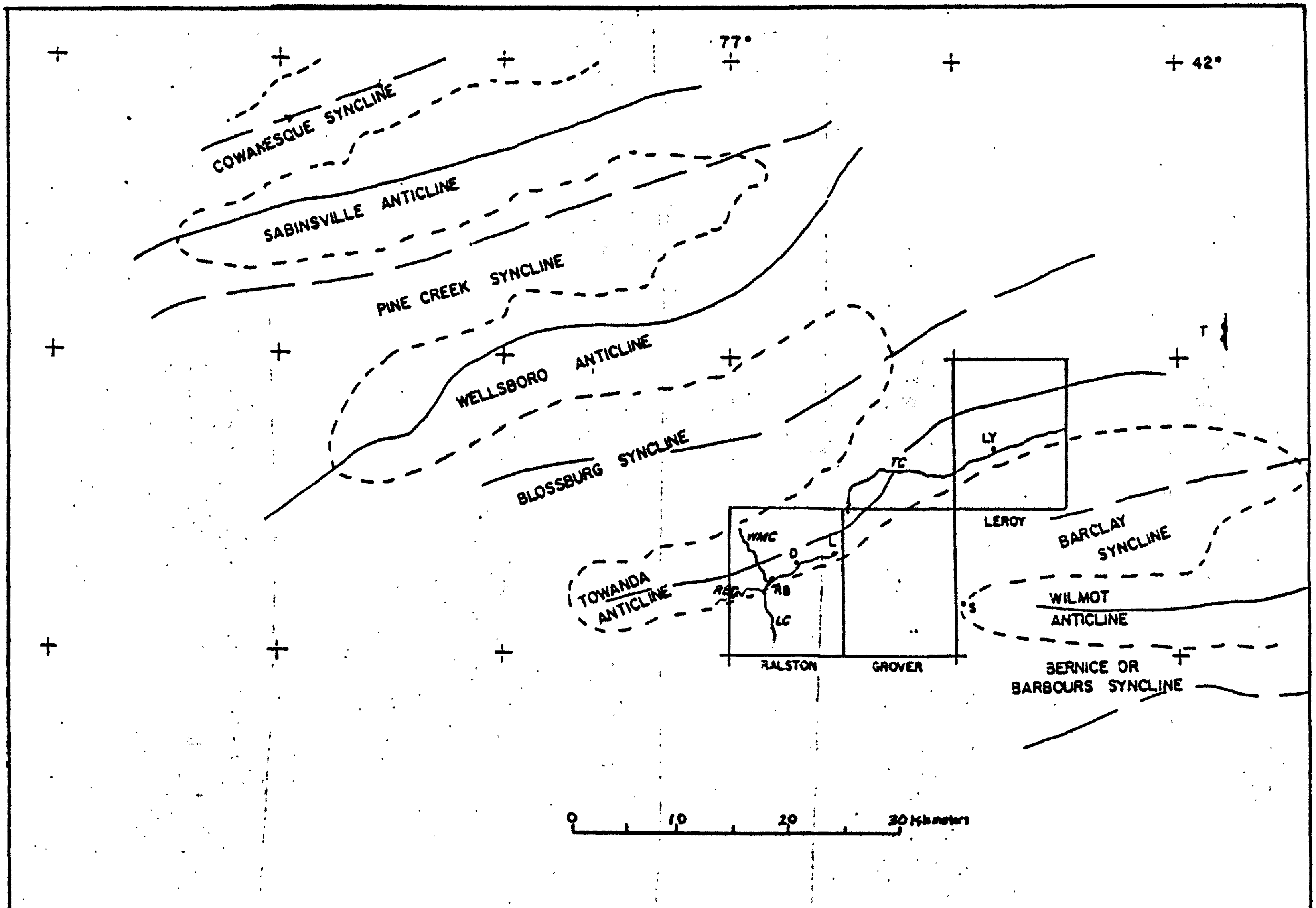
77°
42°
COWANESQUE SYNCLINE
SABINSVILLE ANTICLINE
PINE CREEK SYNCLINE
WELLSBORO ANTICLINE
BLOSSBURG SYNCLINE
TOWANDA ANTICLINE
BARCLAY SYNCLINE
WILMOT ANTICLINE
BERNICE OR
BARBOURS SYNCLINE
LEROY
RALSTON
GROVER
LY
TC
WMC
D
L
RB
RBC
LC
S
T
0
10
20
30 Kilometers

Figure 1

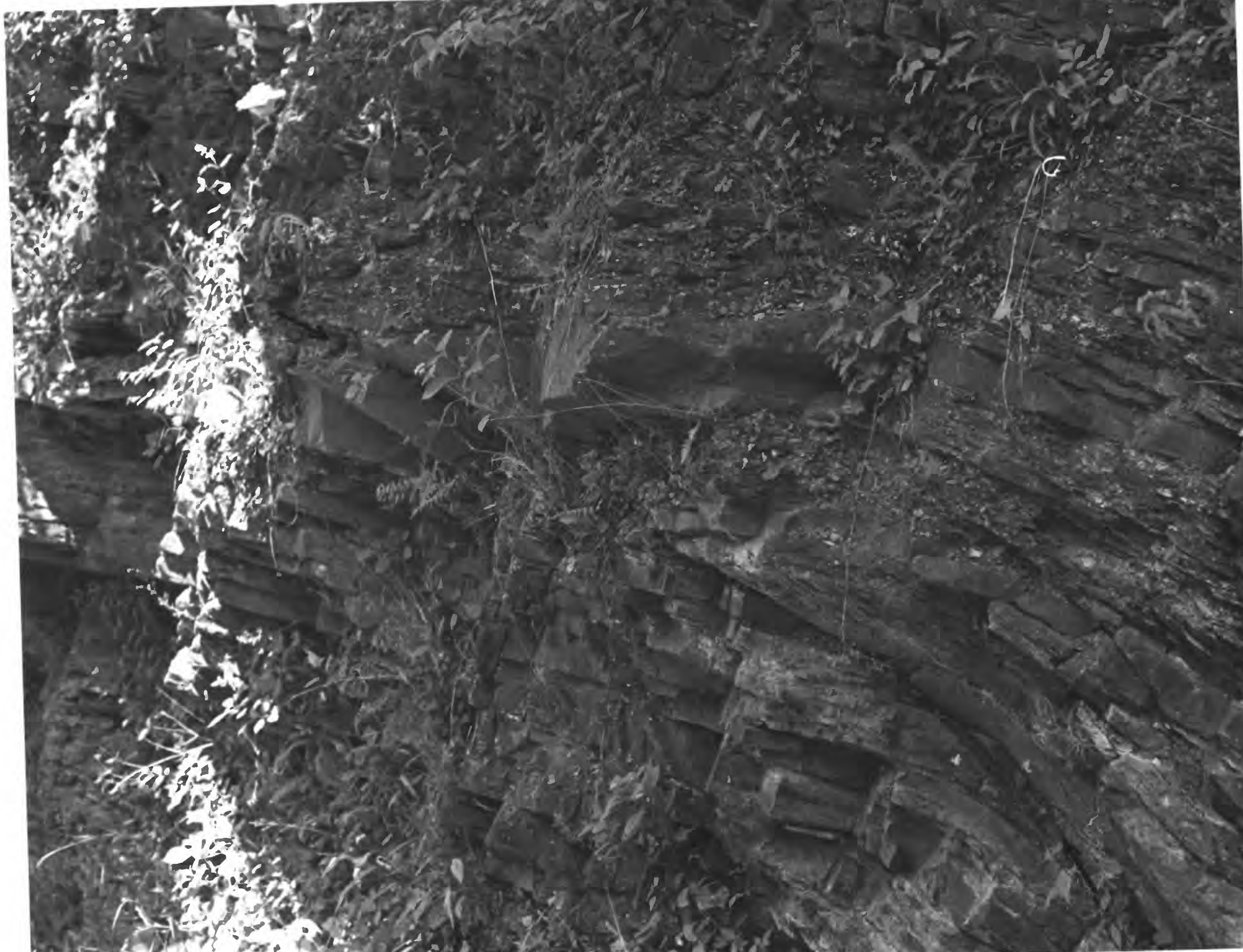

Figure 2

Figure 3

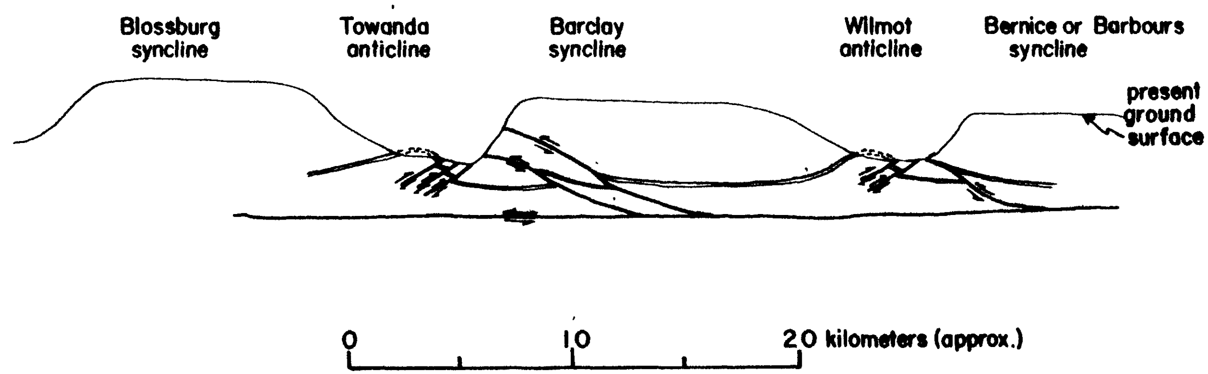
Blossburg syncline
Towanda anticline
Barclay syncline
Wilmot anticline
Bernice or Barbours syncline
present ground surface
0
10
20 kilometers (approx.)

Figure 4