Geometry and Kinematics of Normal Faults, Western Flank of Oquirrh Mountains, Utah

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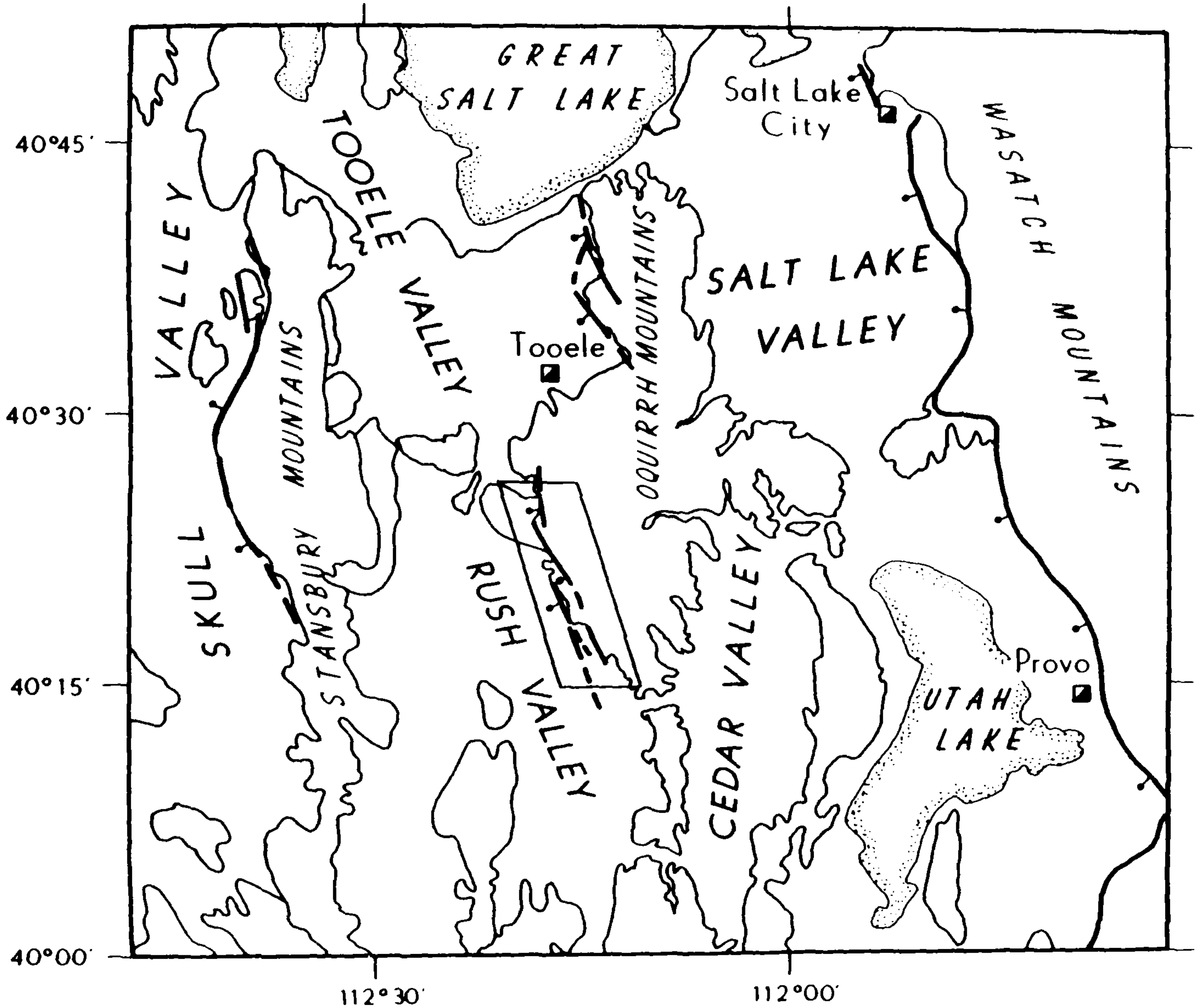
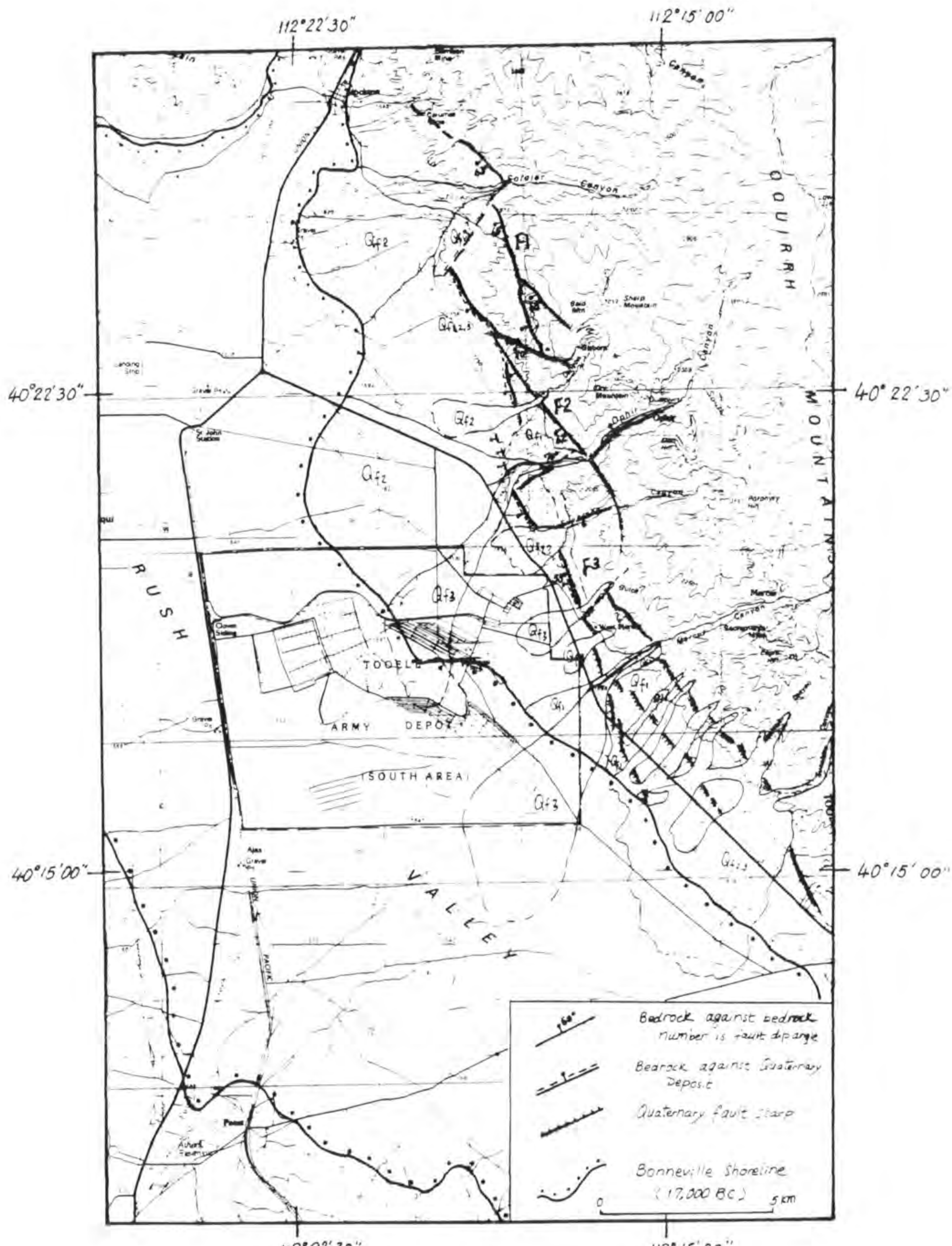
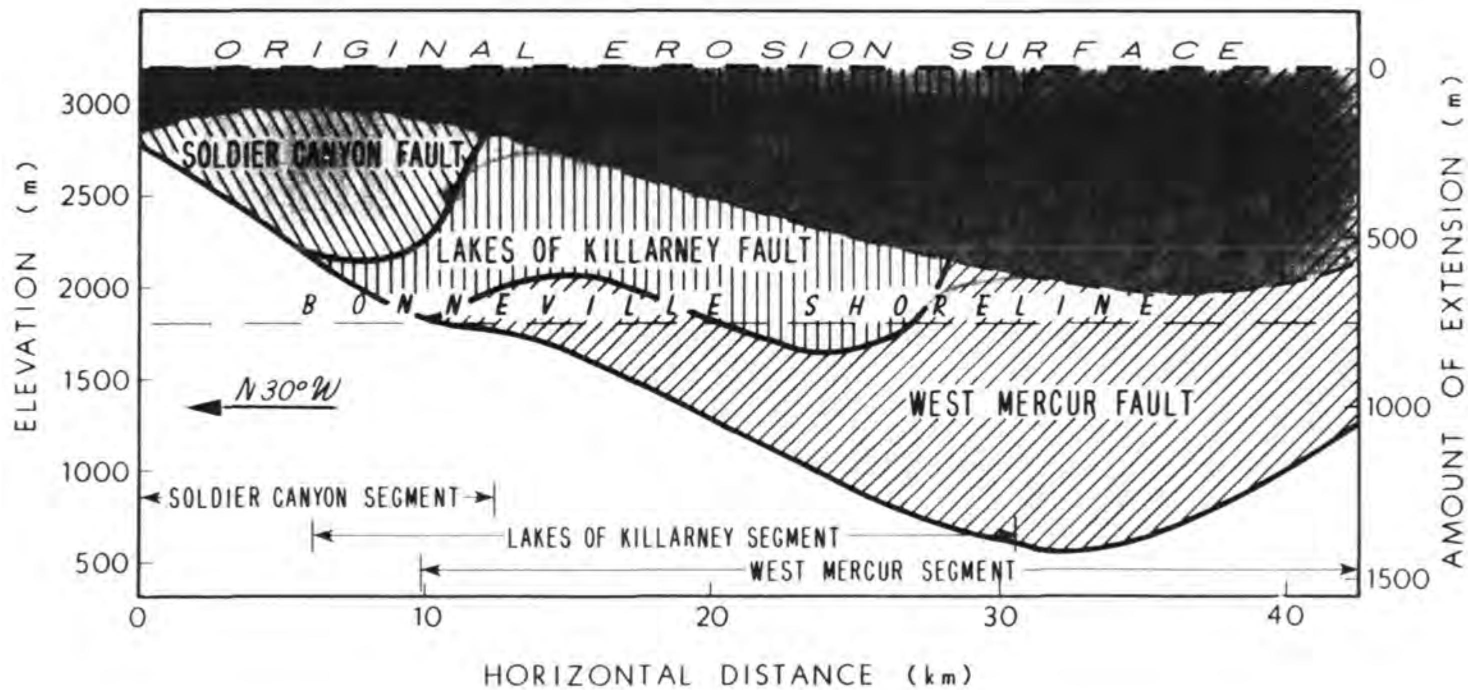
1. Geometry of normal faults along the western flank of the Oquirrh mountains: Three subsidiary fault zones arranged in a right-stepping pattern, and two sets of normal faults with strike-separation of 30° dominate each subsidiary fault zone.

2. Evolution of extension direction: (a) S50°W-N50°E in the early stage of extension; (b) rotated to S75°W-N75°E in the late stage.

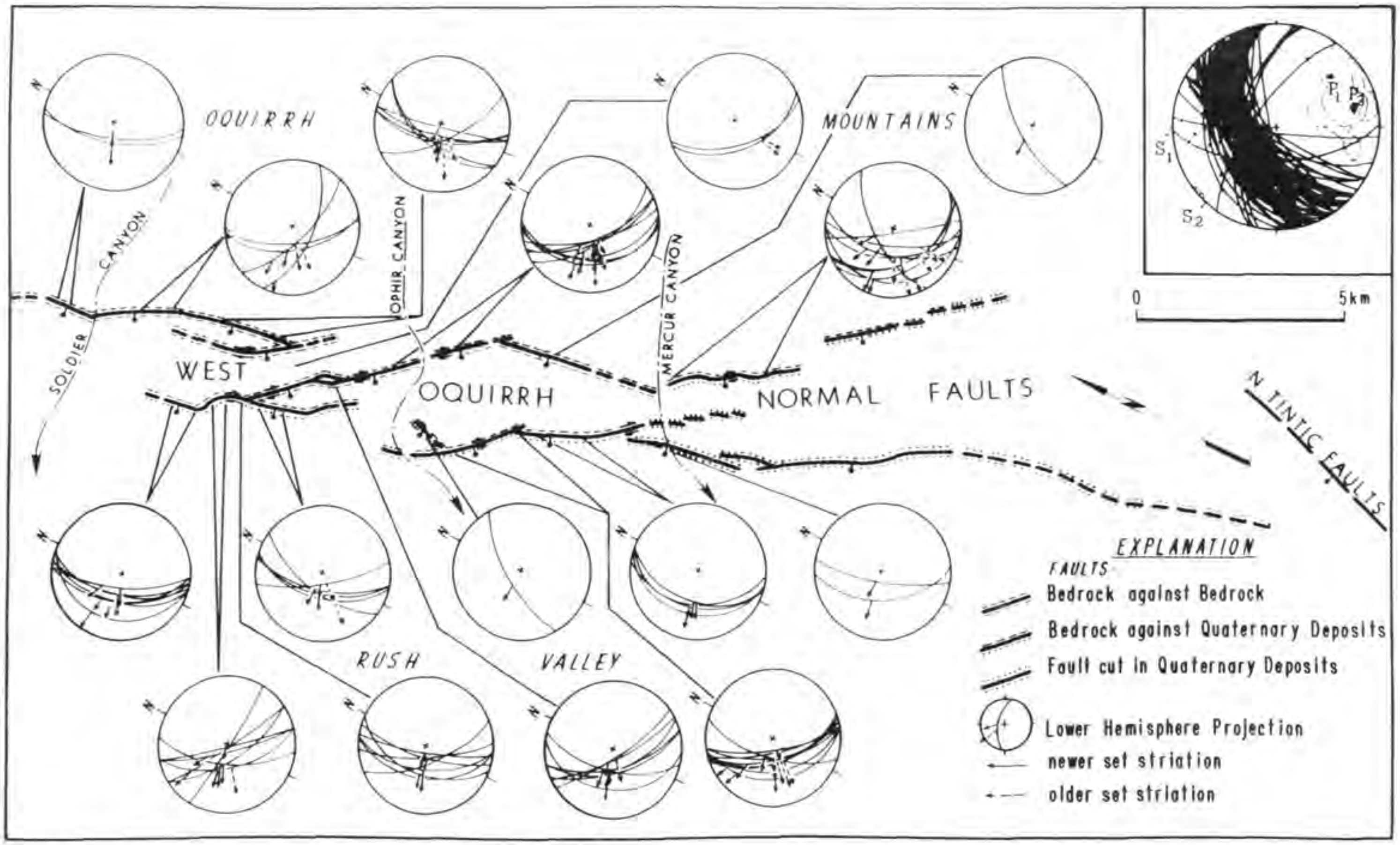
3. Structure of the normal fault zone: Normal fault planes form a complex three-dimensional surface, which appears cylindrical over a limited range in depth. Axes of elongate ridges and furrows are parallel to slip vector of the faults.


GREAT
SALT LAKE
Salt Lake
City
TOOELE
VALLEY
SKULL
VALLEY
STANSBURY
MOUNTAINS
Tooele
OQUIRRH MOUNTAINS
SALT LAKE
VALLEY
WASATCH
MOUNTAINS
RUSH
VALLEY
CEDAR VALLEY
UTAH
LAKE
Provo
40°45′
40°30′
40°15′
40°00′
112°30′
112°00′

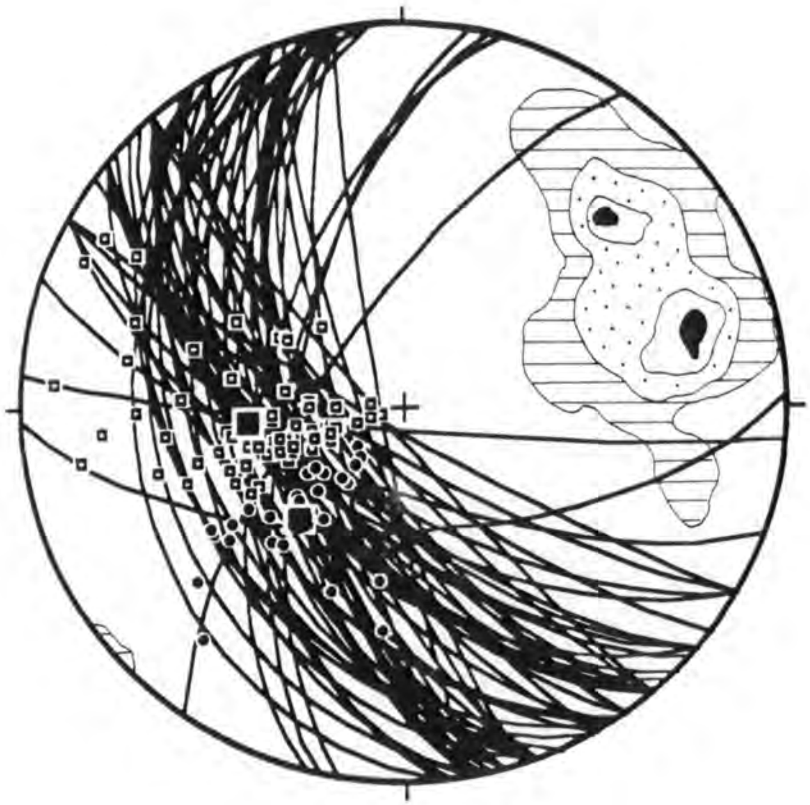

112°22'30"
112°15'00"
40°22'30"
40°15'00"
OQUIRRH MOUNTAINS
RUSH VALLEY
TOOELE ARMY DEPOT
(SOUTH AREA)
F1
F2
F3
Qf1
Qf2
Qf3
Qf2,3
Bedrock against bedrock number is fault dip angle
Bedrock against Quaternary Deposit
Quaternary fault scarp
Bonneville Shoreline (17,000 BC)
0
5 km



ORIGINAL EROSION SURFACE
SOLDIER CANYON FAULT
LAKES OF KILLARNEY FAULT
BONNEVILLE SHORELINE
WEST MERCUR FAULT
N 30° W
SOLDIER CANYON SEGMENT
LAKES OF KILLARNEY SEGMENT
WEST MERCUR SEGMENT
ELEVATION (m)
3000
2500
2000
1500
1000
500
AMOUNT OF EXTENSION (m)
0
500
1000
1500
0
10
20
30
40
HORIZONTAL DISTANCE (km)



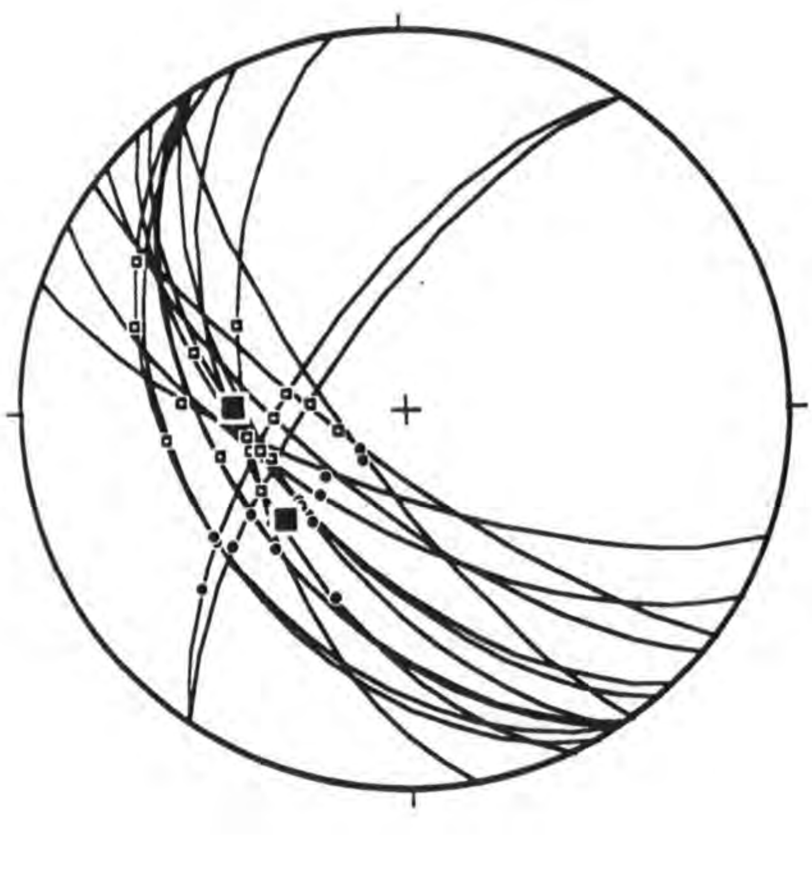
OQUIRRH
MOUNTAINS
SOLDIER
CANYON
OPHIR CANYON
MERCUR CANYON
WEST
OQUIRRH
NORMAL
FAULTS
N TINTIC FAULTS
RUSH
VALLEY
0
5km
EXPLANATION
FAULTS
Bedrock against Bedrock
Bedrock against Quaternary Deposits
Fault cut in Quaternary Deposits
Lower Hemisphere Projection
newer set striation
older set striation



1. Total 109 of measure-ments of fault planes with striations along the West Oquirrh normal faults. There are two sets of fault planes and two sets of striations on average identified in the field:

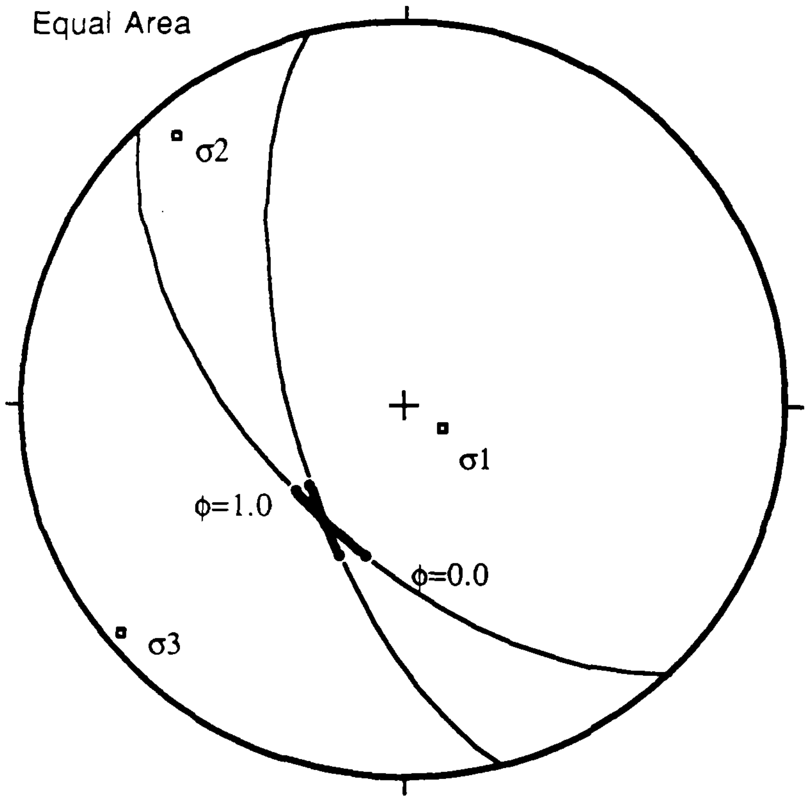
F_1=316°, 60° W
F_2=343°, 68° W
S_1=264°, 57° (Newer)
S_2=222°, 56° (Older)

Open boxes indicates newer set of striations which are superimposed on the older set indicated by dots. Filled boxes indicate the average vector on each set.



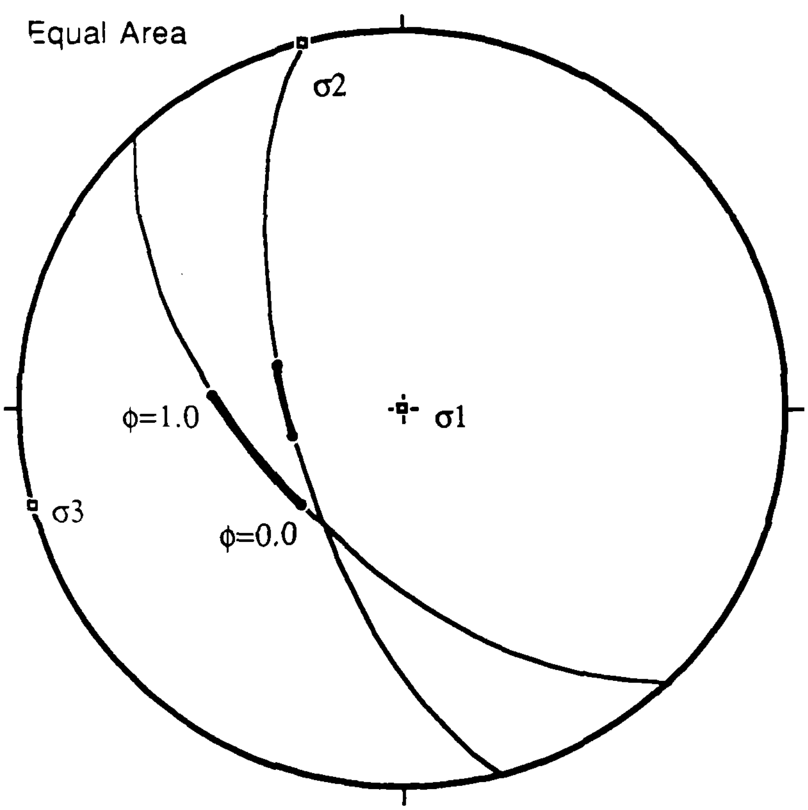
2. The fault planes with two sets of striations and their average slip vectors.

S_1=271, 57 (Newer)
S_2=227, 56 (Older)



	Trend	Plunge
$\sigma 1$	120°±10°	80°±10°
$\sigma 2$	320°±10°	9°±10°
$\sigma 3$	230°±10°	4°±10°

1. range of slip lines on the fault sets at the early stage of extension



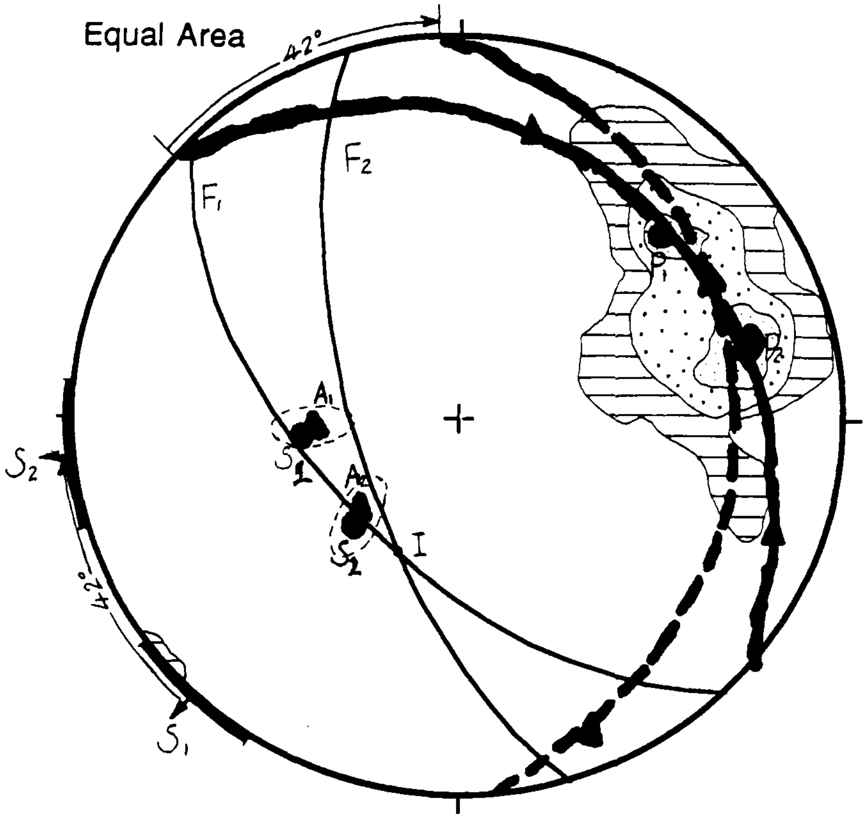
	Trend	Plunge
$\sigma 1$	0°±10°	90°±10°
$\sigma 2$	345°±10°	0°±10°
$\sigma 3$	255°±10°	0°±10°

2. Range of slip lines on the fault sets at the later stage of extension

$\phi=(\sigma 2-\sigma 3)/(\sigma 1-\sigma 3)$

$\phi=1.0 \quad \sigma 1=\sigma 2$

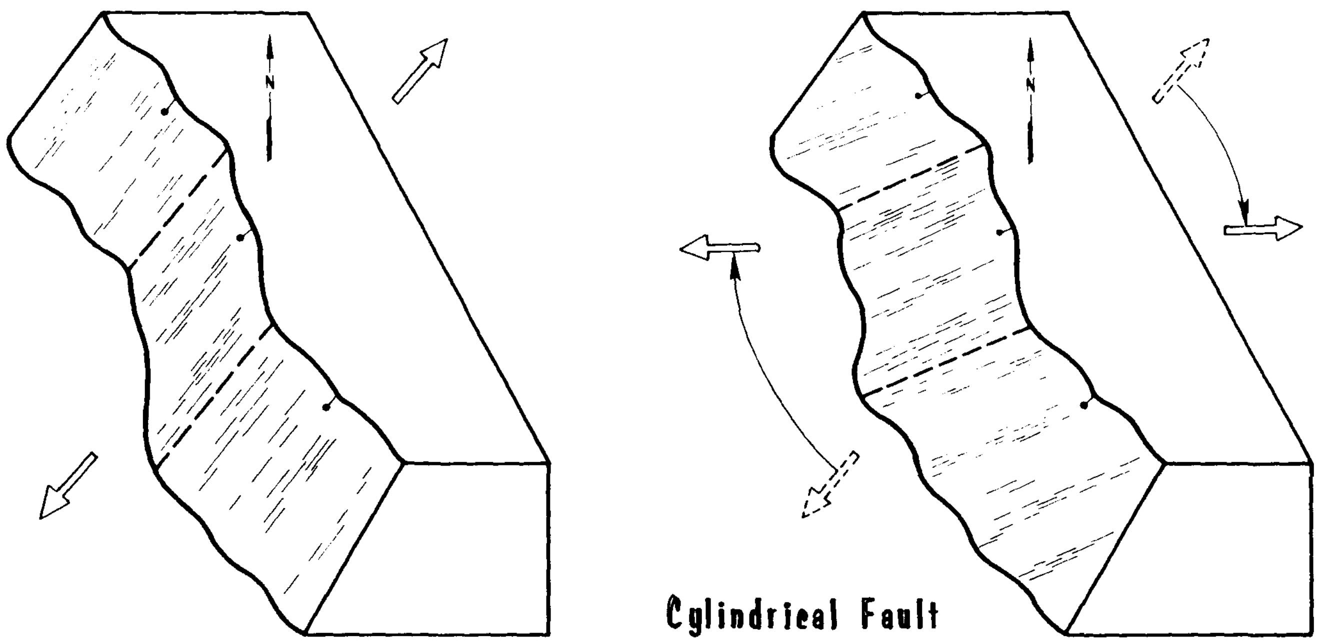
$\phi=0.0 \quad \sigma 2=\sigma 3$



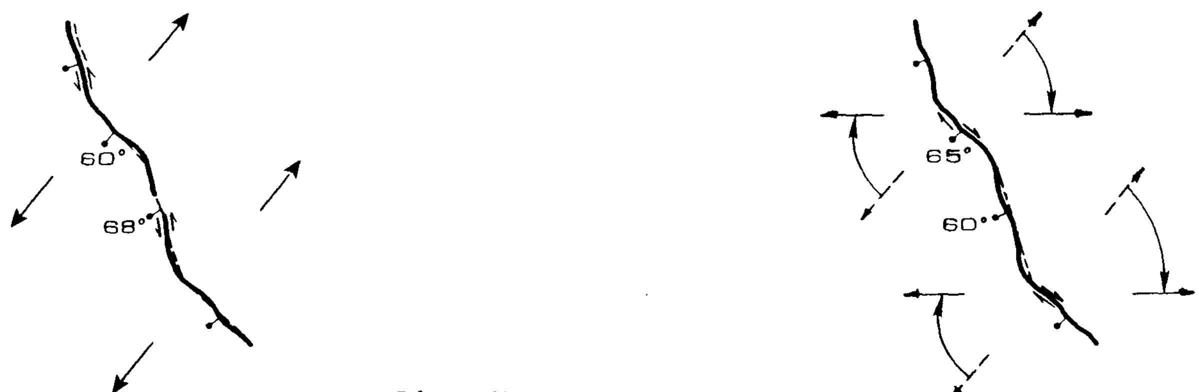
1. Contoured equal area stereonet of total measurements of the fault planes and striations on these planes. Contour intervals are 2 % per 1 % area, 6 % per 1 % area, and 10 % per 1 % area. S_1 is the newer set of striation which is superimposed on the older set (S_2). P_1 and P_2 correspond with fault sets F_1 and F_2, respectively. Dashed great circles are the best fit planes for all poles of fault planes and triangles are cylindrical axes of the best fit planes. The blue is before rotation and the yellow one is after rotation. The filled square (S_1) is the newer set of striations on average and open square (S_2) is the older set of striations on average.

I=Intersection line of two main sets of fault planes on average. A1=the cylindrical fold axes of the best fit plane for all poles of fault planes after rotation. A2=the cylindrical fold axes of the best fit plane for all poles of fault planes before rotation.

(1) BEFORE ROTATION **(2) AFTER ROTATION**



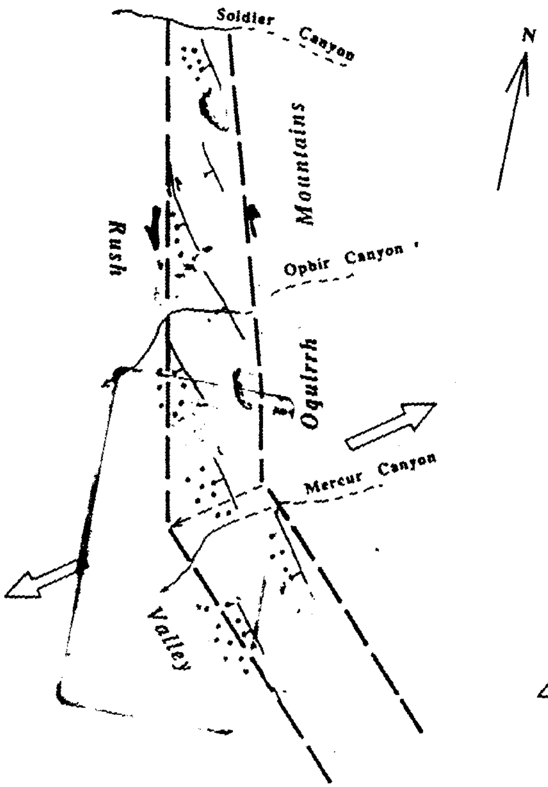
Cylindrical Fault Plane Structures



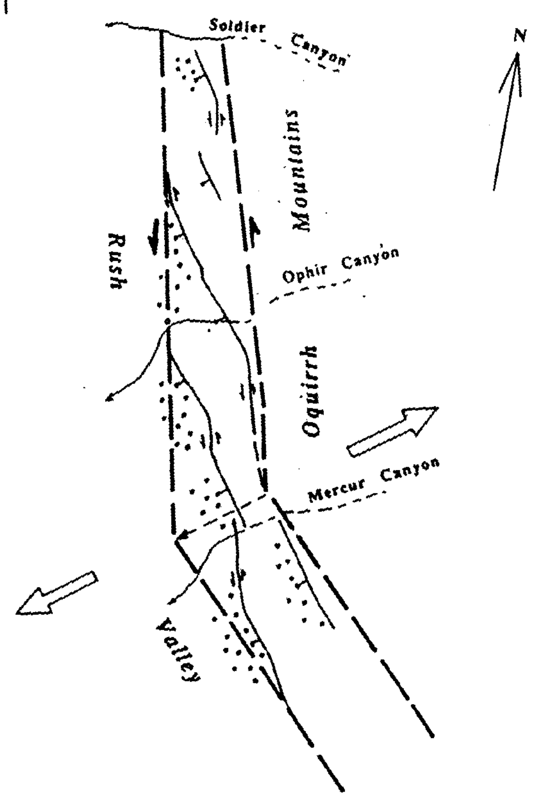
Plane View of Fa[illegible] Trace

Early stage of Extension

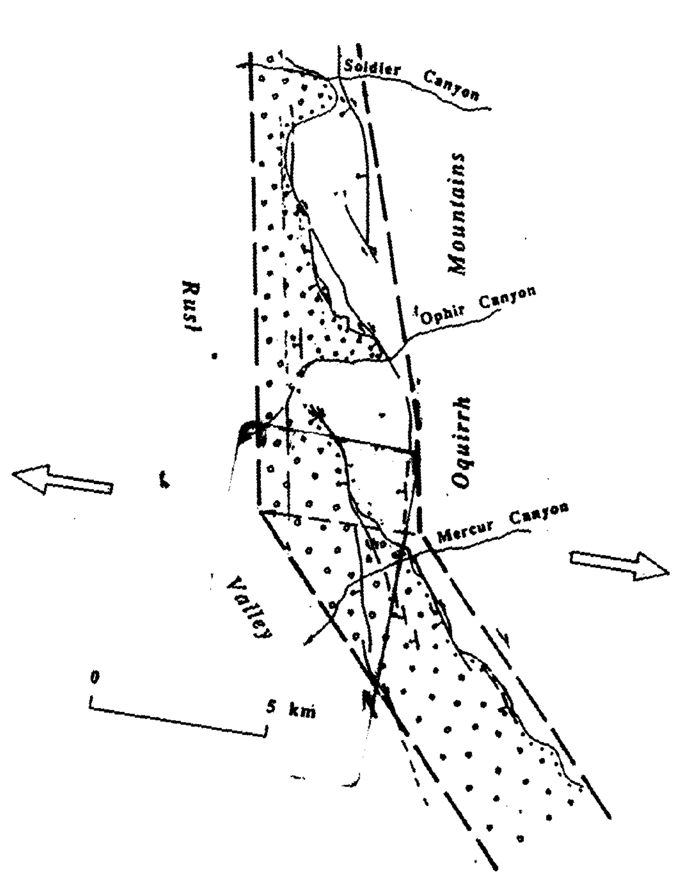
(1)



(2)



Late stage of Extension



CONCLUSION

1. The normal fault zone along the western flank of the southern Oquirrh Mountains consists of three subsidiary fault zones arranged in a right-stepping pattern. Each subsidiary fault zone trends N35°W on average.

2. Each fault zone is composed of two fault sets: One striking N15°±10°W with almost pure dip-slip displacement at present, and the other striking N45°±10°W with normal-oblique-slip. The latter fault set has 30% right lateral shear component. The two sets of faults form a complex, three-dimensional "enveloping" surface with axes of topographic elongation parallel to the slip-vector.

3. Fault surfaces contain two sets of slicken-lines; one set is superimposed on the other. The stress tensor inversion based upon the two sets of slicken lines indicates S50W-N50E extension with the ϕ value = 0.4 during the early stage of faulting; and S75W - N75E extension with ϕ=0.2 under the present tectonic regime. The regional strain field has rotated at least 25°±10° in this part of Utah since extension began.