URANIUM RESOURCES IN THE RED BASIN-PIETOWN DISTRICT, CATRON COUNTY, NEW MEXICO

Virginia T. McLemore, New Mexico Bureau of Geology and Mineral Resources, New Mexico Institute of Mining and Technology, Socorro, NM 87801, ginger@gis.nmt.edu

U2011, Casper, Wy September 20, 2011

Acknowledgments

- Most of this talk is based upon prior work
- Uranium deposits were first described by Melancon (1953), Griggs (1954), Bachman et al. (1957), Collins (1957)
- Richard Chamberlin (1982) mapped in detail the Datil area and developed the model described here
- David Guilinger (1982) mapped the Pietown area in conjunction with Chamberlin
- NURE data included a detailed ground water study of the Datil-Pietown area
- Steve Cather described the Baca Basin and source terrain
- Various company and AEC file data

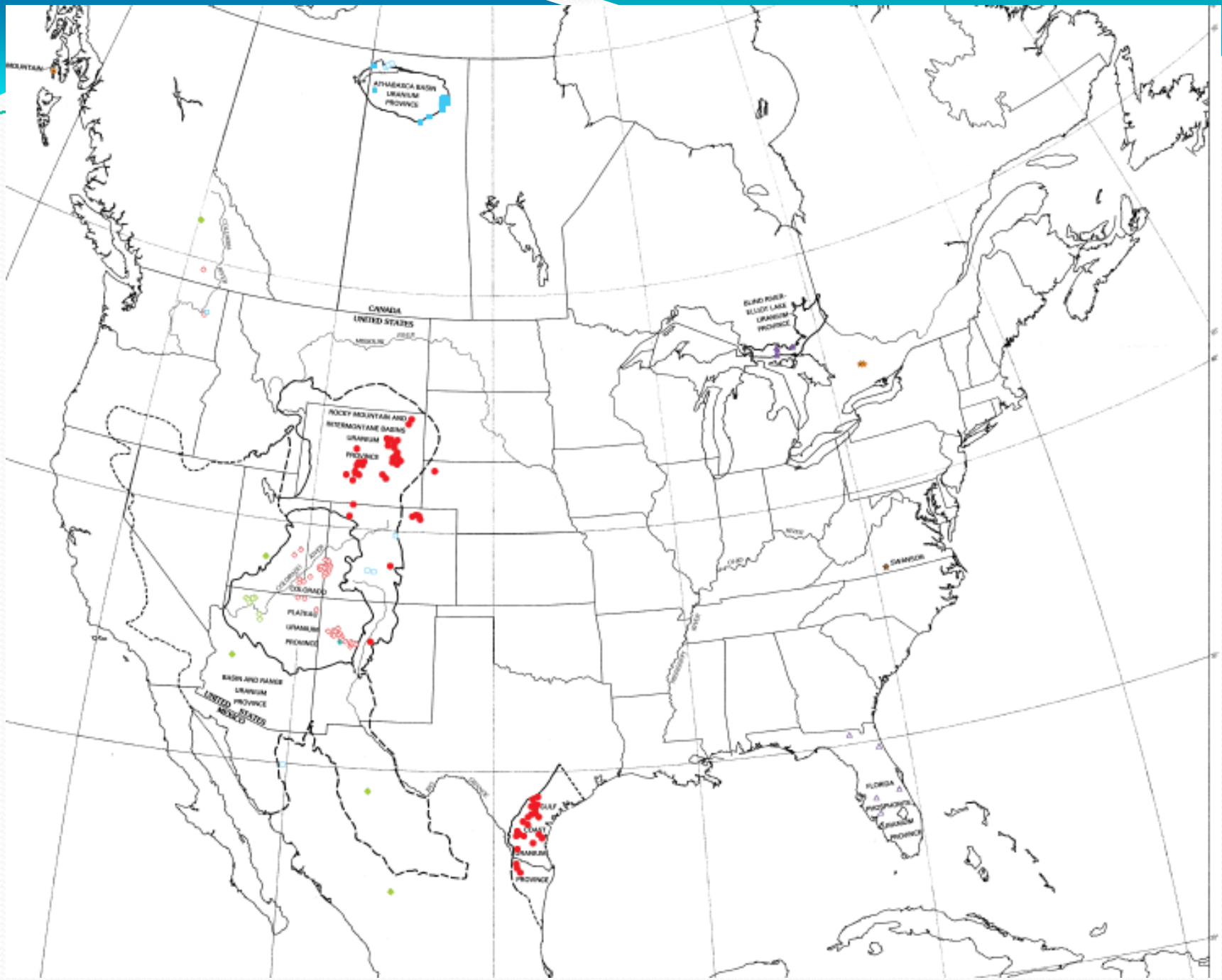
THIS STUDY

- Field examination and limited geochemistry
- Use GIS ArcMap to show spatial relationships between geology, structure, locations of mines and uranium occurrences, and the NURE data
- Identify potential sources of uranium
- Refine Chamberlin model

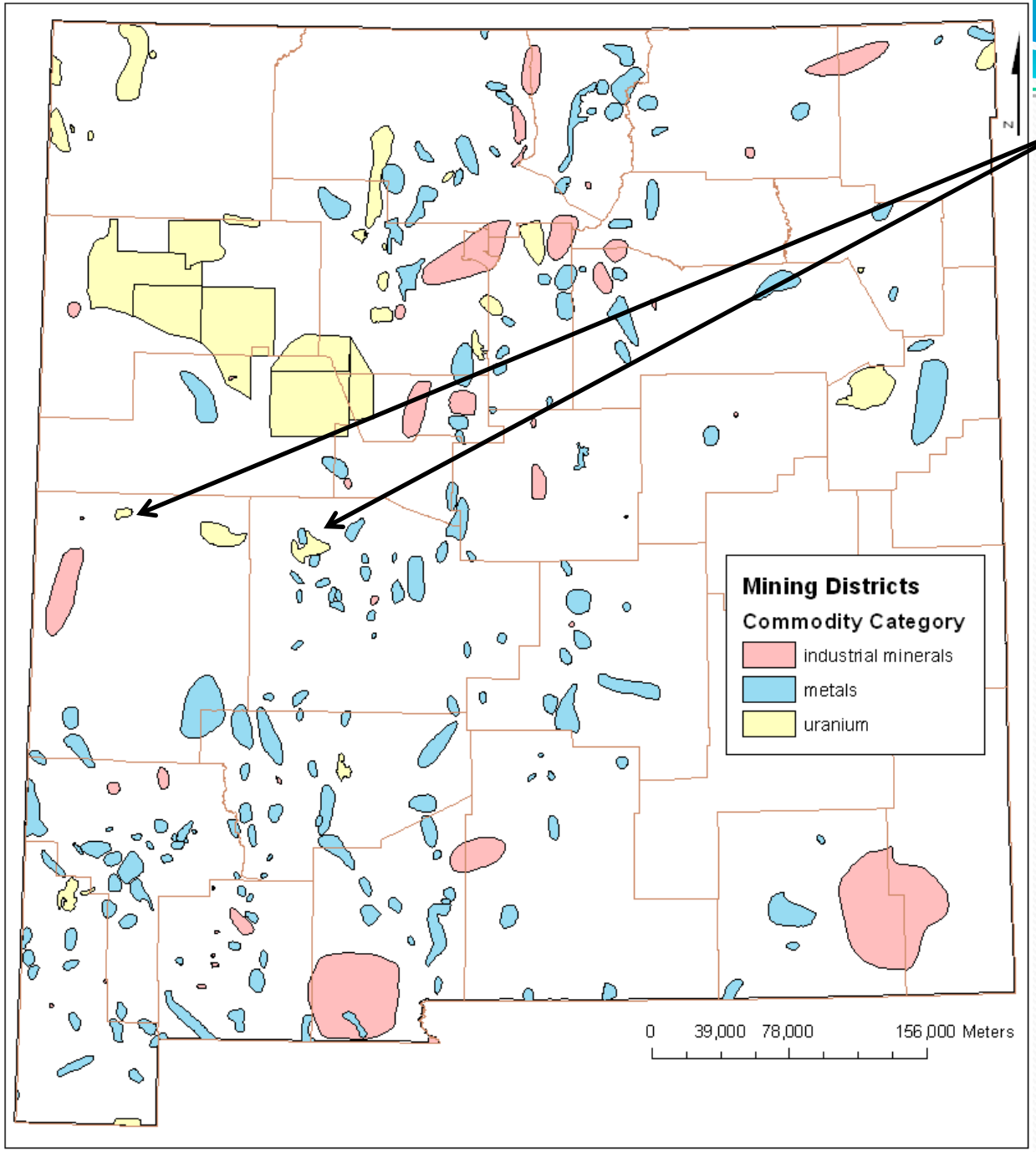
OUTLINE

- Introduction
- Description of the uranium deposits
- Source of uranium
- Sequence of events
- Future research/questions
- Other areas?

INTRODUCTION


ATHABASCA BASIN
URANIUM
PROVINCE
CANADA
UNITED STATES
ROCKY MOUNTAIN AND
INTERMONTANE BASINS
URANIUM
PROVINCE
COLORADO
PLATEAU
URANIUM
PROVINCE
BASIN AND RANGE
URANIUM
PROVINCE
UNITED STATES
MEXICO
GULF
COAST
URANIUM
PROVINCE
FLORIDA
PHOSPHATE
URANIUM
PROVINCE
BLIND RIVER-
ELLIOT LAKE
URANIUM
PROVINCE
SWANSON

Location of Red Basin-Pietown and Hook Ranch-Riley districts



Past Production

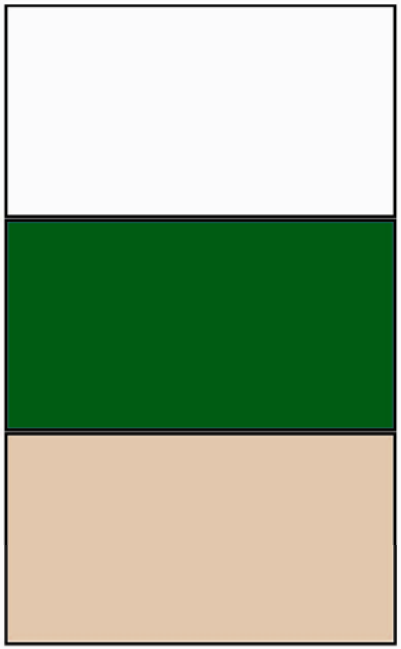
- Red Basin-Pietown district
  - From 1954-1957
  - 1,194 lbs of U_3O_8
  - grade 0.17% U_3O_8
- Hook Ranch-Riley district
  - From 1954-1961
  - 306 lbs of U_3O_8
  - grade 0.18% U_3O_8

DESCRIPTION OF THE URANIUM DEPOSITS

Distribution of uranium

- Unaltered Crevasse Canyon sandstones (associated with organic material)
- **Baca sandstones (associated with redox boundaries and organic material)**
- **Palesol at top of Crevasse Canyon Formation (redox boundaries)**
- Minor uranium anomalies in Cretaceous coal and shale
- Minor uranium anomalies in rhyolites

Stratigraphy



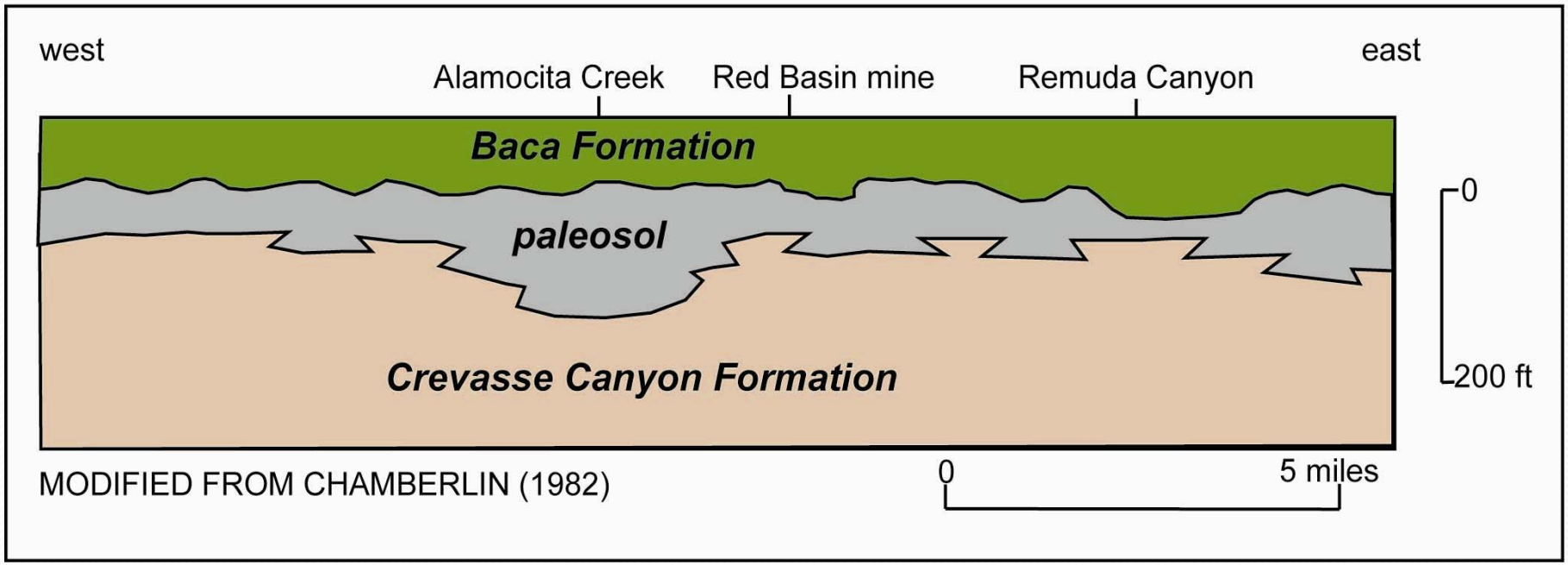
Oligocene Datil-Mogollon volcanics (700-1500 ft thick)--rhyolite, andesite, volcanclastic rocks

Eocene Baca Formation (1800-1900 ft thick)--sandstones, mudstones, conglomerates deposited in a Laramide basin

Cretaceous Crevasse Canyon Formation (1100-1700 ft thick)--sandstones, shales and minor coal deposited in a coastal plain environment

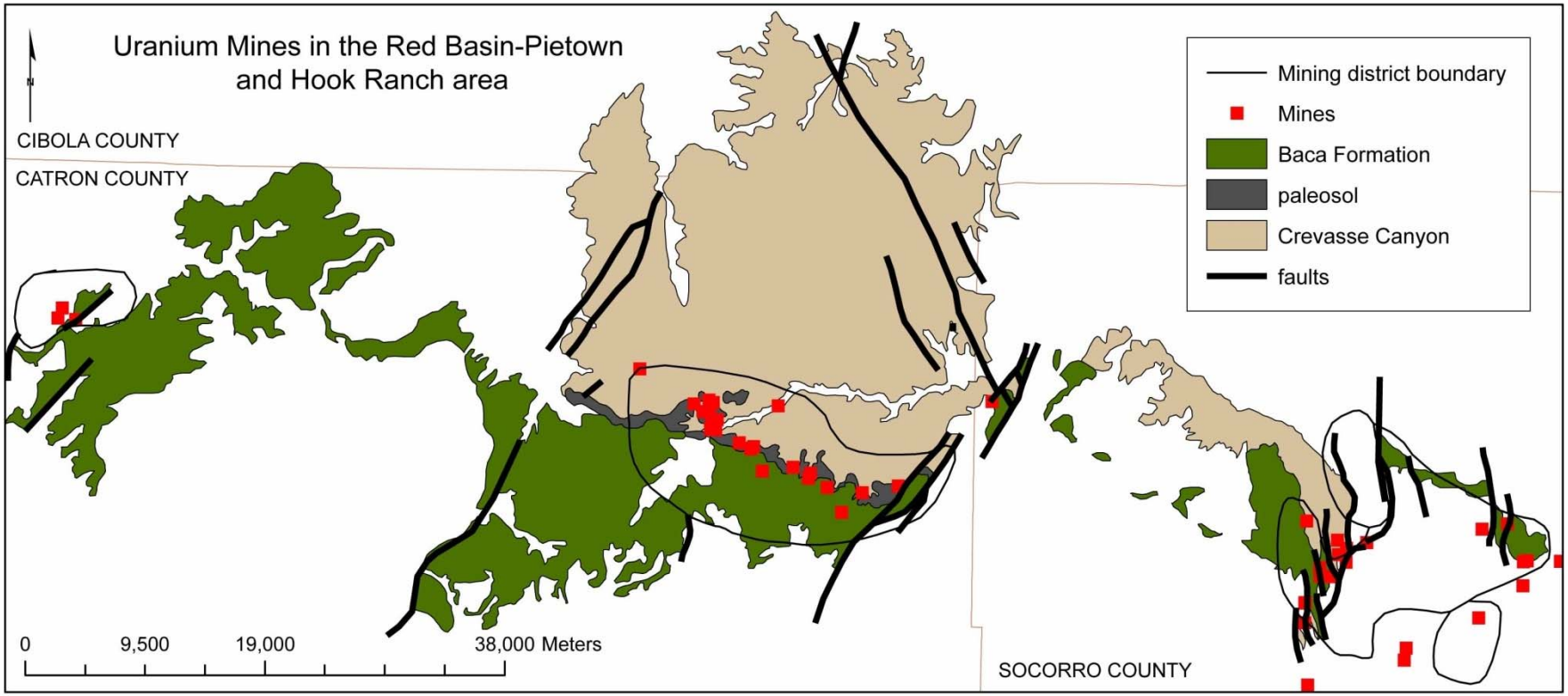
Palesol developed at the top of the Crevasse Canyon sandstones and shales

- Oxidized, mottled colors
- Local uranium anomalies associated with redox boundaries
- Hematite-limonite concretions (after pyrite)
- Local silicified logs
- Fragments of palesol in overlying Baca Formation

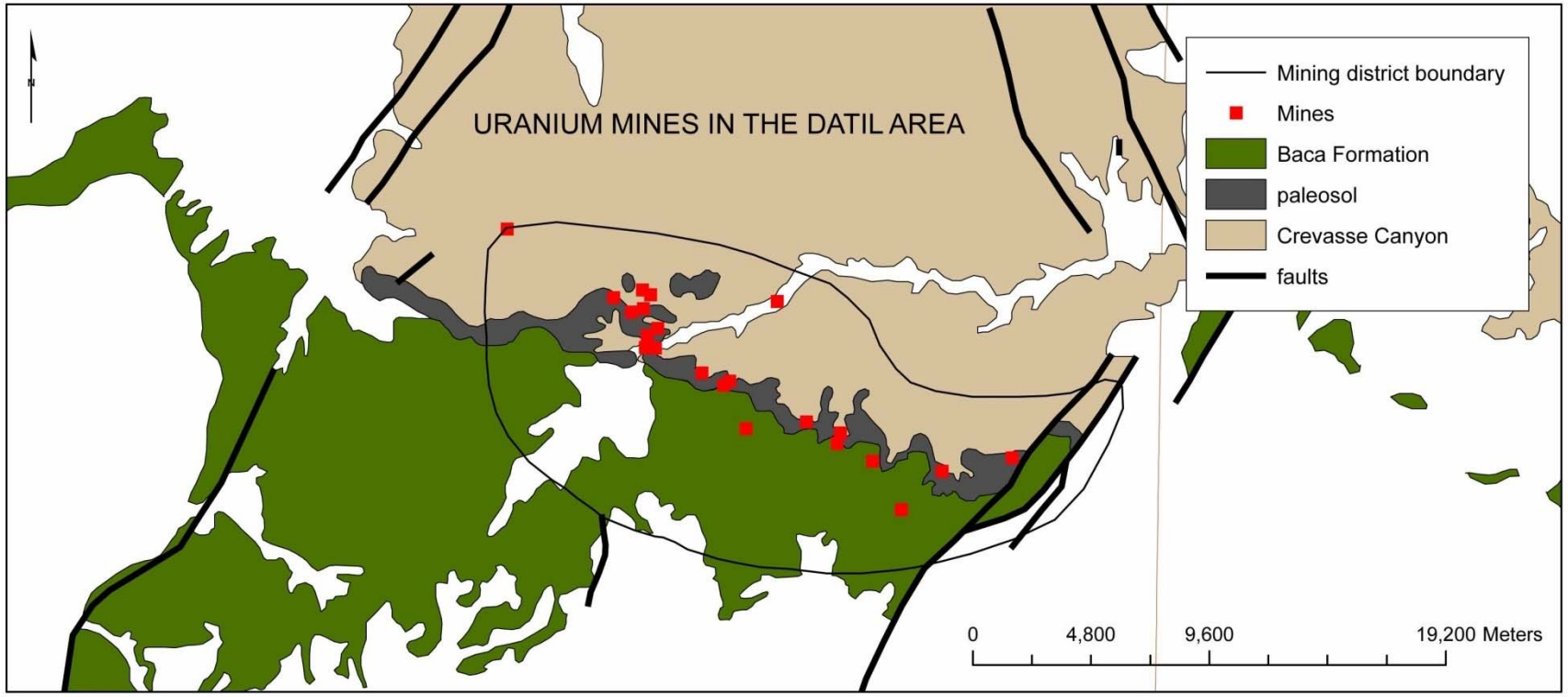

west
east
Alamocita Creek
Red Basin mine
Remuda Canyon
Baca Formation
paleosol
Crevasse Canyon Formation
0
200 ft
MODIFIED FROM CHAMBERLIN (1982)
0
5 miles

Radioactive oxidation-reduction front in the Crevasse Canyon paleosol

Radioactive oxidation-reduction front in the Crevasse Canyon paleosol



Geology from Chamberlin (1982) and the state geologic map, mines from McLemore (2011, the NM Mines Database)


URANIUM MINES IN THE DATIL AREA
Mining district boundary
Mines
Baca Formation
paleosol
Crevasse Canyon
faults
0
4,800
9,600
19,200 Meters

Uranium deposit in the Crevasse Canyon paleosol

Uranium mineralization

Strategic Resources Inc. (Red Basin)

- Drilling by Federal Resources in 1981-1982, Strategic Resources in 2011
- Contact of the paleosol and unaltered shale of the Crevasse Canyon Formation
- 2 ft thick zones, 0.01% eU_3O_8
- Waiting on additional drill permits

Vane Minerals (Red Basin)

- Deer Claim project
- Drilling by Gulf Minerals in 1970s
- Contact of the paleosol and shale of the Crevasse Canyon Formation
- Waiting on drill permits

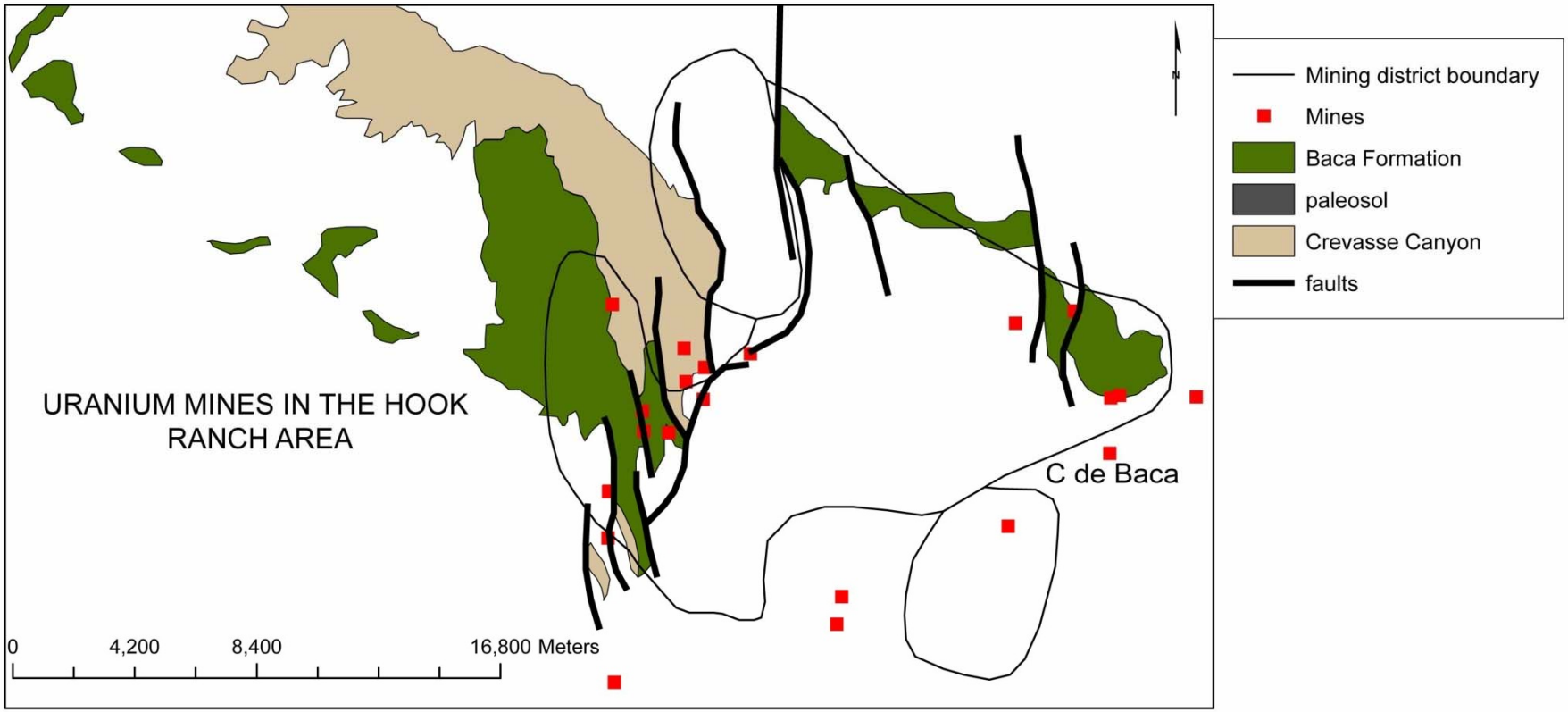
Uranium Energy Corp (Arizona)

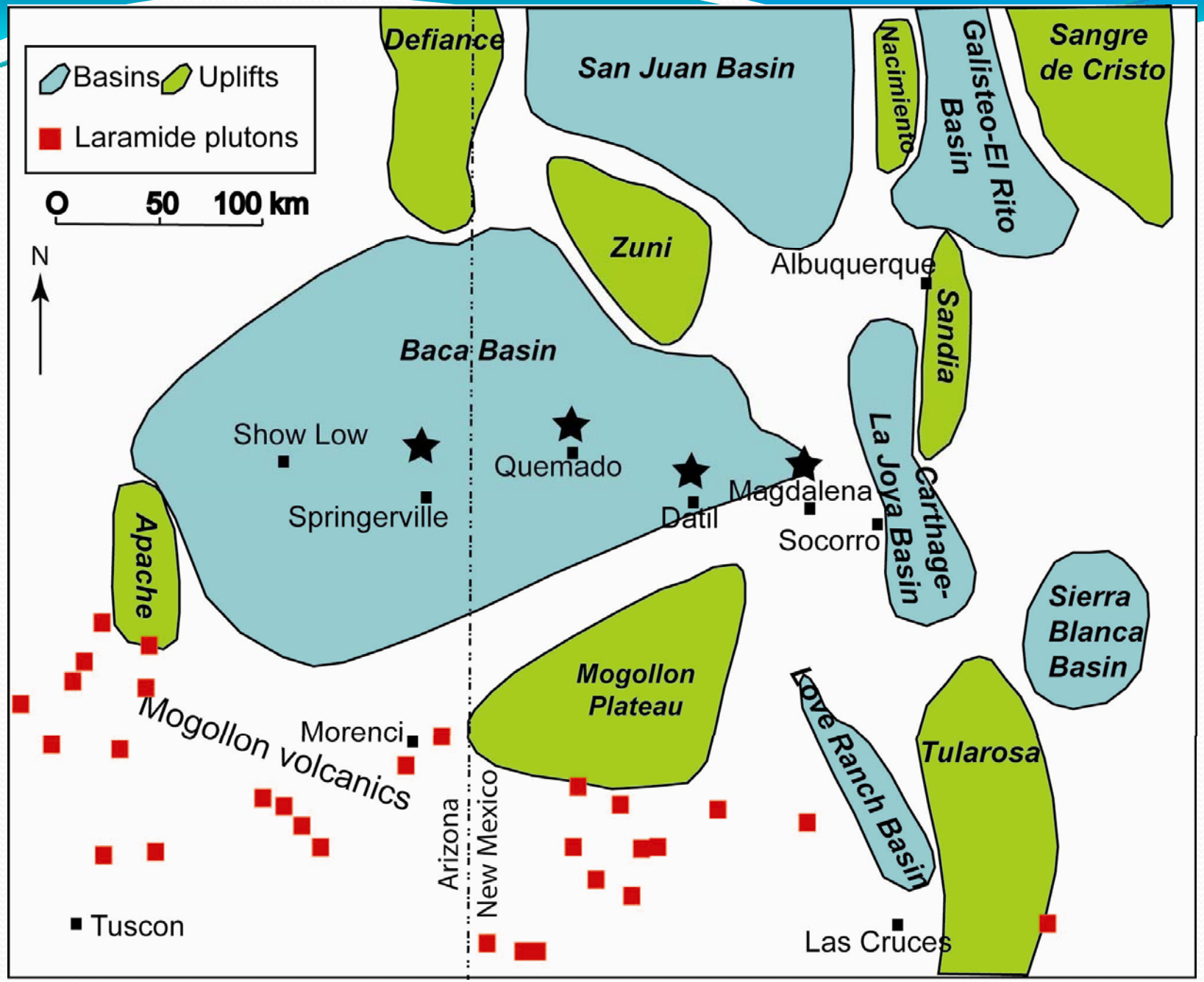
- Coyote Ranch project
- Apache County, Arizona (just west of NM-AZ line)
- Occidental Minerals drilled in the Baca Formation and Cretaceous Mesaverde Group

Max Resources Corp

C de Baca property (Hook Ranch-Riley)

- Drilling by Oxymin in 1981-1982, Max Resources in 2007-2008
- 1.67 million tons U_3O_8 at 0.18% (historic resource)
- 6 million pounds U_3O_8
- Not NI 43-101 compliant
- Middle gray unit of the Eocene Baca Formation
- Braided stream channels


URANIUM MINES IN THE HOOK RANCH AREA
C de Baca
0
4,200
8,400
16,800 Meters
Mining district boundary
Mines
Baca Formation
paleosol
Crevasse Canyon
faults


Basins
Uplifts
Laramide plutons
0 50 100 km
N
Defiance
San Juan Basin
Nacimiento
Galisteo-El Rito Basin
Sangre de Cristo
Zuni
Albuquerque
Sandia
Baca Basin
La Joya Basin
Carthage-
Show Low
Quemado
Springerville
Datil
Magdalena
Socorro
Apache
Sierra Blanca Basin
Mogollon Plateau
Mogollon volcanics
Morenci
Love Ranch Basin
Tularosa
Arizona
New Mexico
Tuscon
Las Cruces

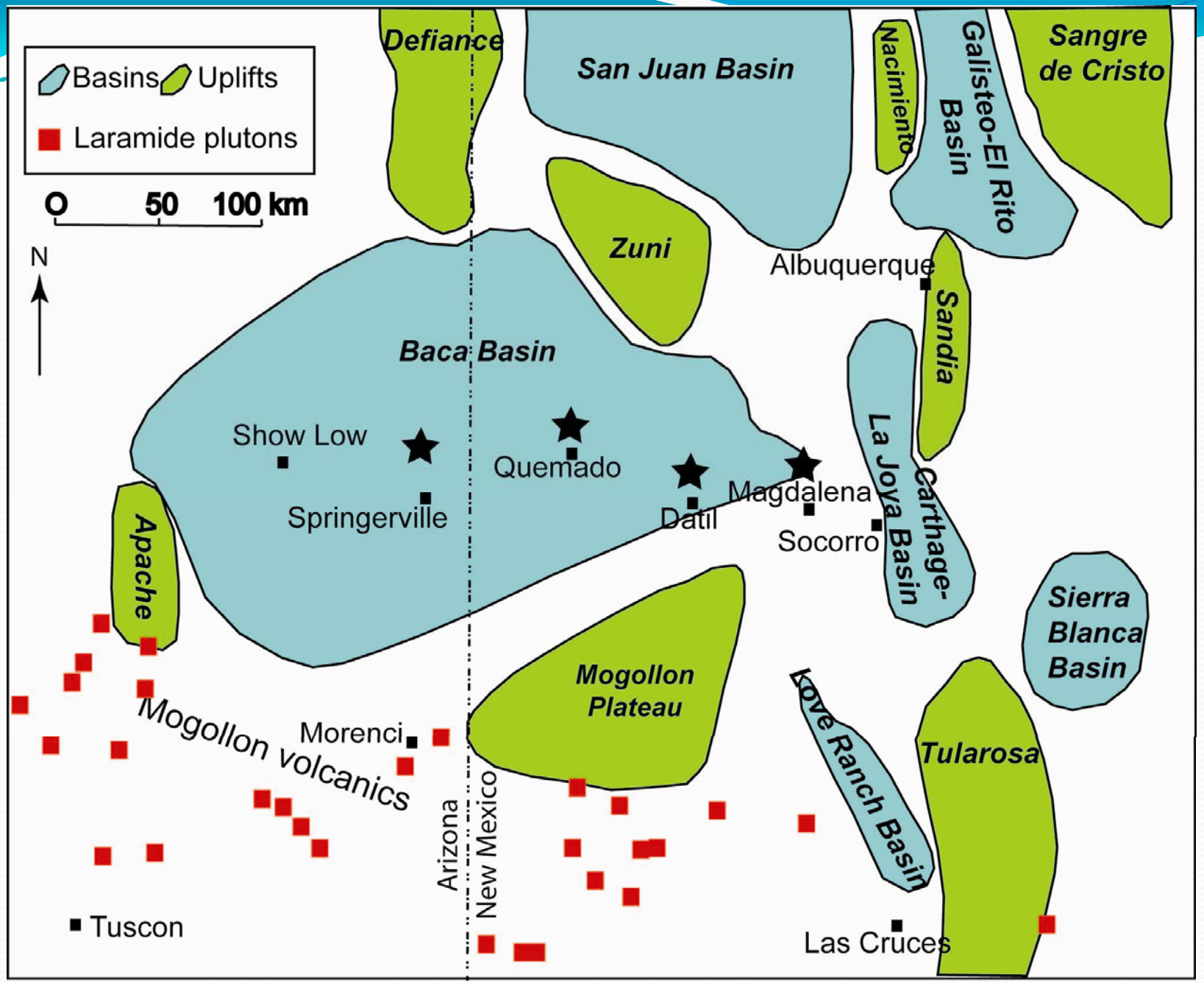
SOURCE OF URANIUM

Crevasse Canyon Formation

- 10-25 ppm U in shales
- 10-60 ppm U in coal

Volcanic highland

- Cretaceous plutonic rocks in the southwest (porphyry copper deposits and Laramide plutons)
- Some of the Crevasse Canyon sediments could contain eroded material from these plutons
- Tertiary volcanic rocks in the Datil-Mogollon volcanic field to the southwest (~100 ppm in some rhyolites)
- Meteoric water dissolves uranium from volcanic and plutonic rocks and transport into the Baca Basin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0 50 100 km
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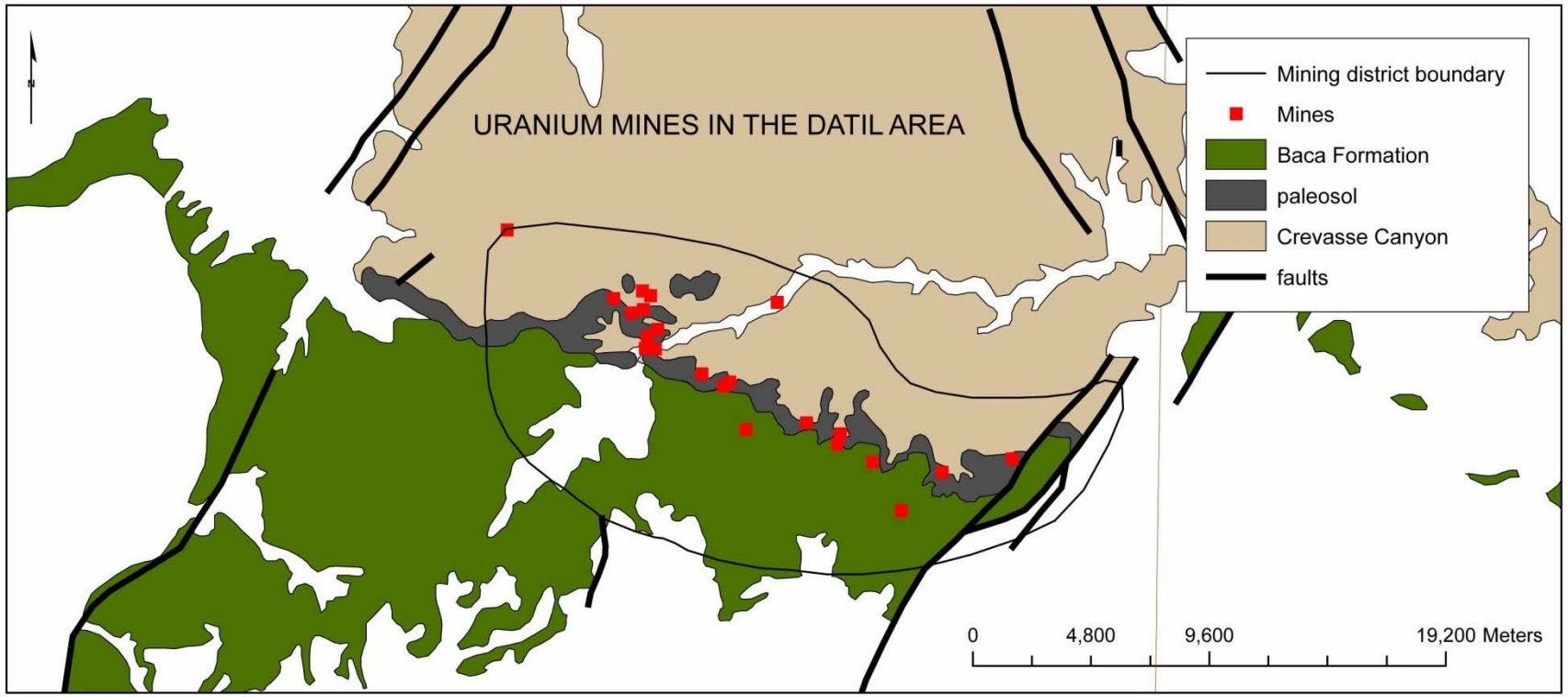
SEQUENCE OF EVENTS

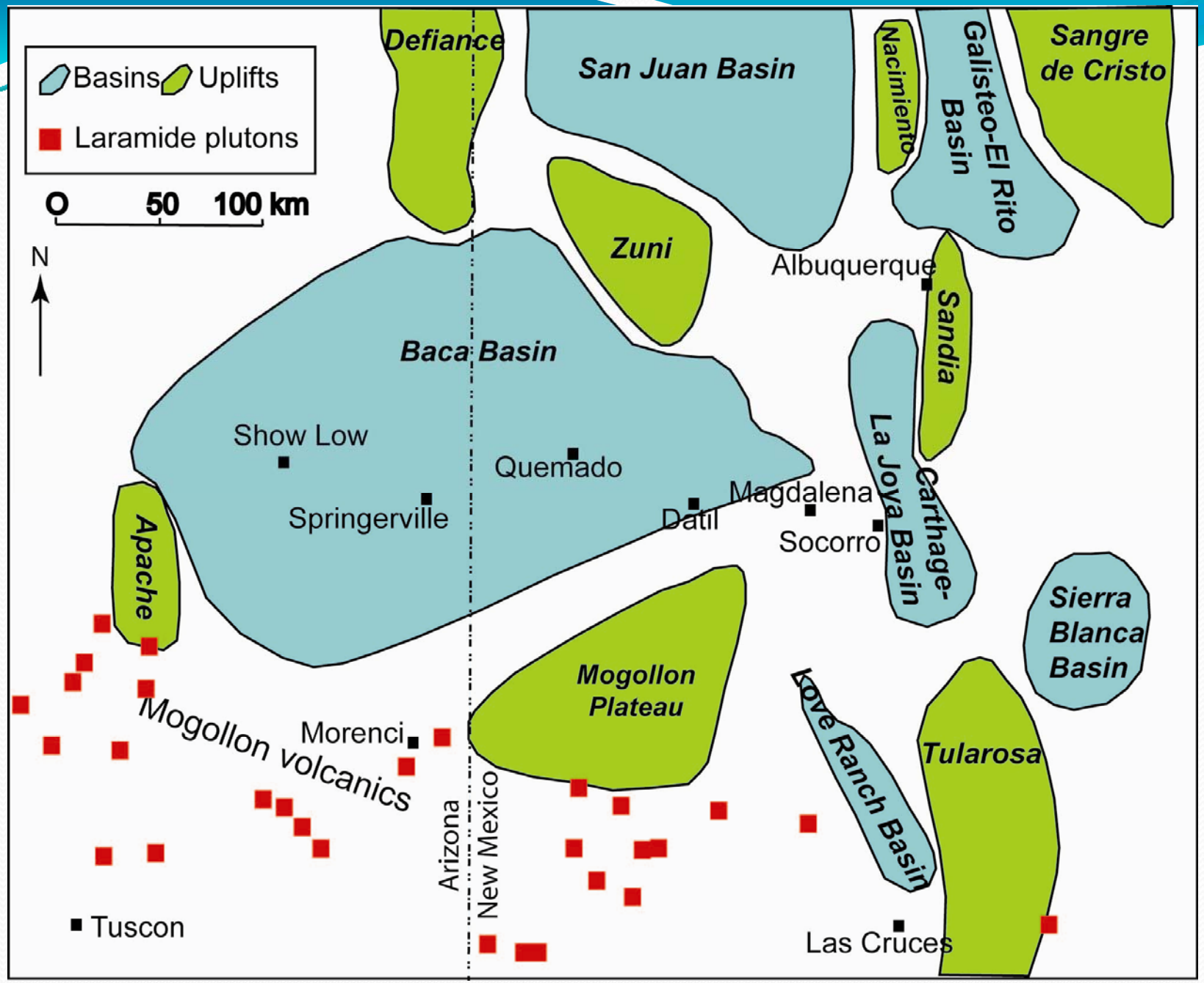
Sequence of events—modified Chamberlin model

- Late Cretaceous—deposition of the Crevasse Canyon Formation (fluvial sandstones and shales-wet, warm climate)
- Laramide—folding and faulting
- Paleocene—development of a palesol (lateritic soil) at the top of the Crevasse Canyon Gormation and deposition of uranium at redox boundaries (roll-type) leached from shales and possibly Late Cretaceous intrusions (drier, warm climate)


URANIUM MINES IN THE DATIL AREA
Mining district boundary
Mines
Baca Formation
paleosol
Crevasse Canyon
faults
0
4,800
9,600
19,200 Meters

Sequence of events—modified Chamberlin model

- Eocene—late Laramide uplifts, flushing of uranium-rich waters from Mogollon uplift into the Baca Basin
- Deposition of the Baca Formation and burial of the palesol and older uranium deposits (dry climate)


Basins
Uplifts
Laramide plutons
0 50 100 km
N
Defiance
San Juan Basin
Nacimiento
Galisteo-El Rito Basin
Sangre de Cristo
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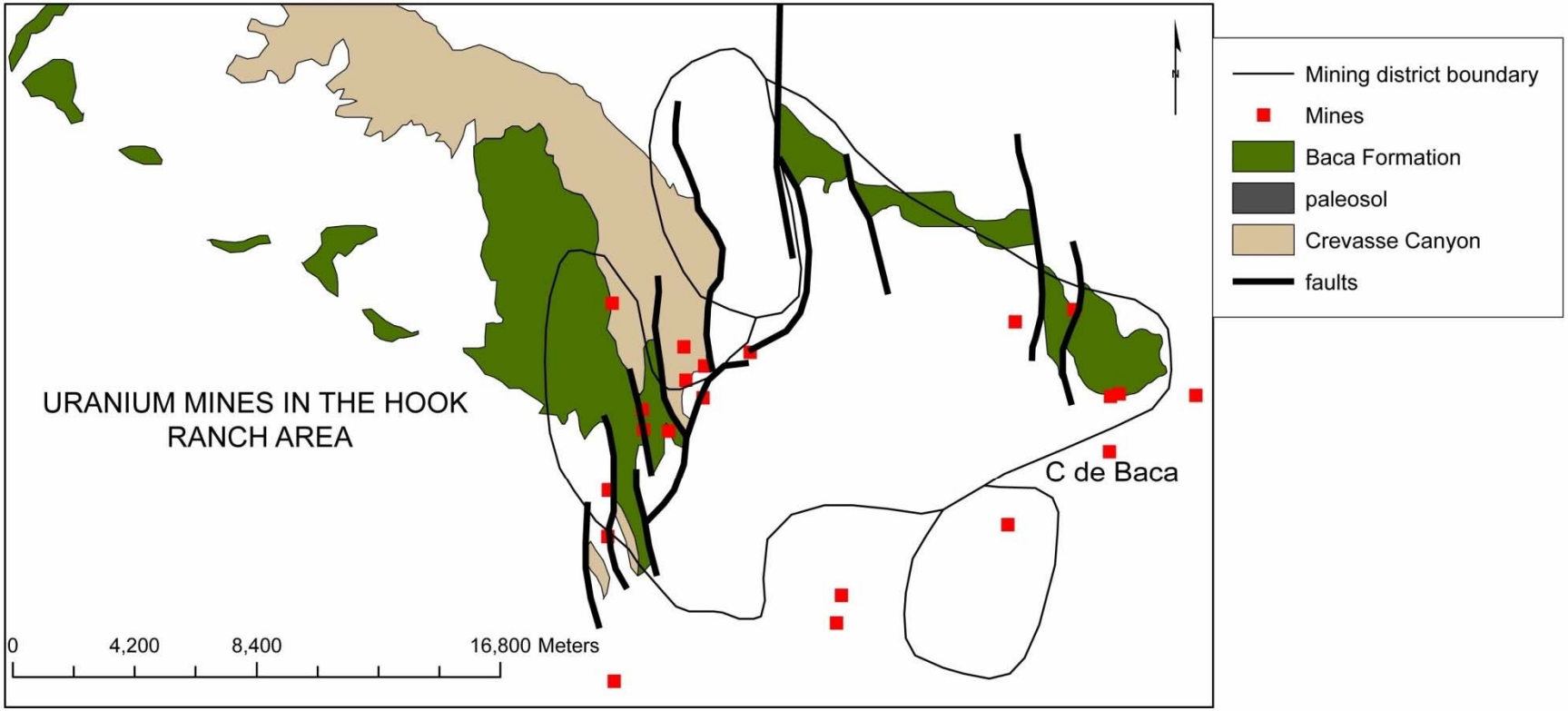
Sequence of events—modified Chamberlin model

- Deposition of the Mogollon-Datil volcanic rocks
- Uplift
- Roll-type deposits in the Baca Formation


URANIUM MINES IN THE HOOK RANCH AREA
C de Baca
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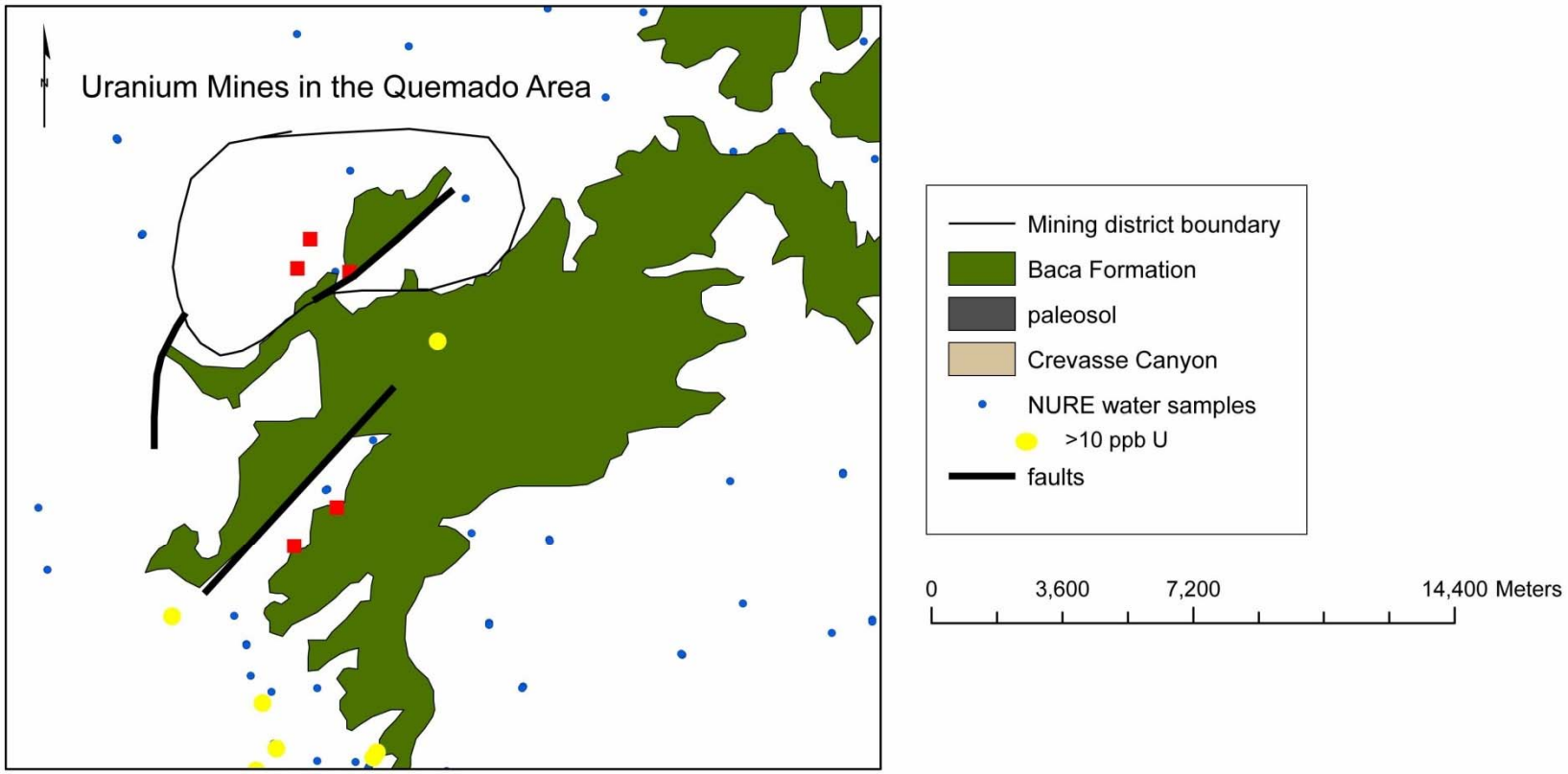
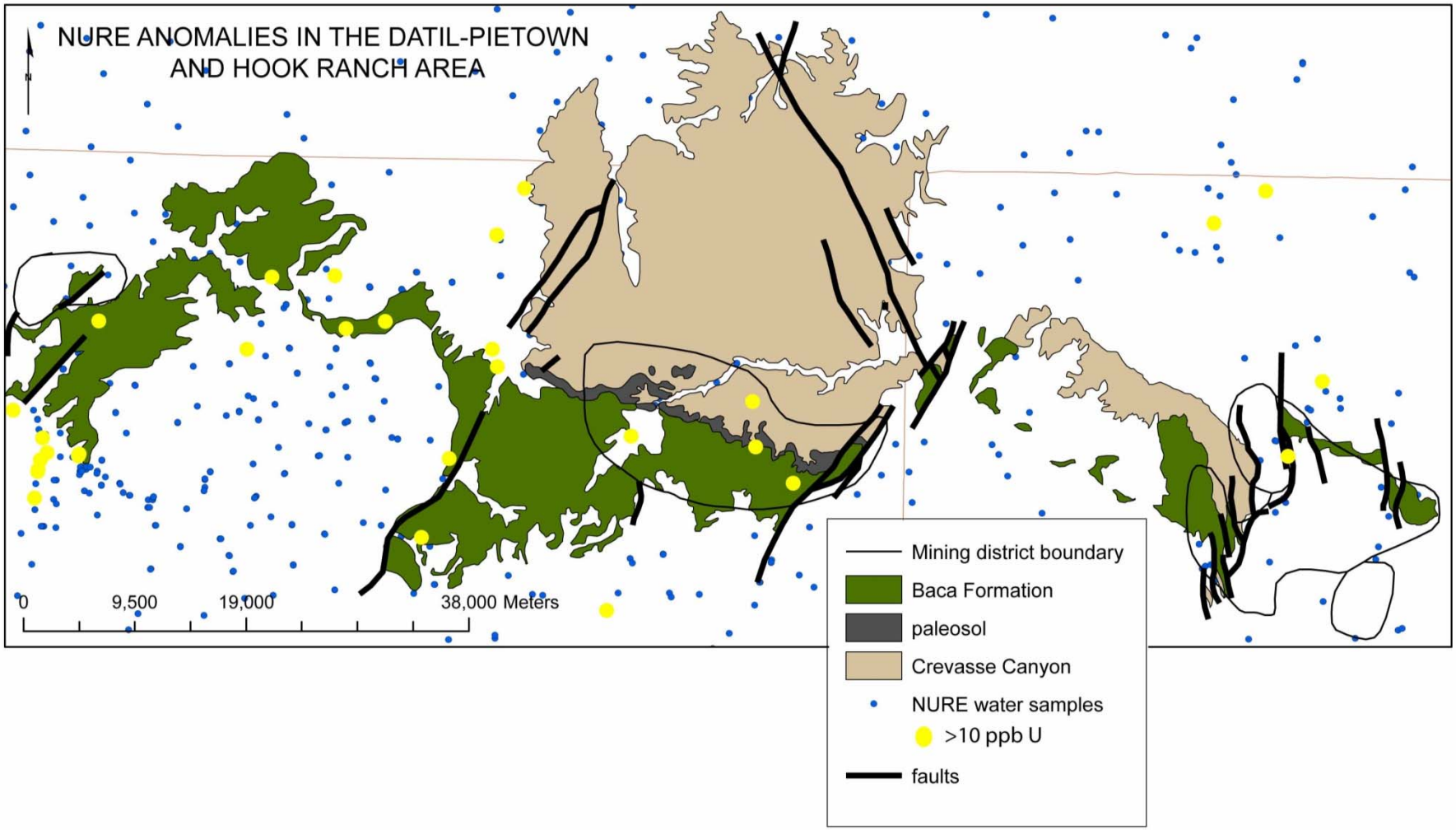
4,200
8,400
16,800 Meters
Mining district boundary
Mines
Baca Formation
paleosol
Crevasse Canyon
faults

Sequence of events—modified Chamberlin model

- Late Cenozoic-present—uplift and tilting of sediments followed by redistribution of uranium, locally along faults (fault zone in the Quemado area)
- Redistribution of uranium continues today as evidenced by the NURE groundwater anomalies


Uranium Mines in the Quemado Area
Mining district boundary
Baca Formation
paleosol
Crevasse Canyon
NURE water samples
>10 ppb U
faults
0
3,600
7,200
14,400 Meters


NURE ANOMALIES IN THE DATIL-PIETOWN
AND HOOK RANCH AREA
0
9,500
19,000
38,000 Meters
Mining district boundary
Baca Formation
paleosol
Crevasse Canyon
NURE water samples
>10 ppb U
faults

COMMENTS

- No uranium mills remain in New Mexico.
- The Red Basin-Pietown, Hook Ranch-Riley deposits could be recovered by ISR.
- The Navajo Nation has declared that no uranium production will occur in Indian Country. Alamo Reservation is in the Hook Ranch-Riley area.

FUTURE RESEARCH/QUESTIONS

- Drilling to delineate deposits
- Mineralogy of the deposits
- Age determinations
  - Are the deposits in the Red Basin-Pietown and Hook Ranch the same age?
  - Are there two or more stages of roll-type deposits?
- Geochemical analyses of the sediments and ore deposits (trace elements)
- What is the relationship of the groundwater anomalies to the uranium deposits?

OTHER TERTIARY BASINS?