Esta ponencia fue presentado por el Dr. George Veni
en el Primer Seminario Sobre el Manejo Sostenible de Karst
en Coban, Alta Verapaz, Guatemala el 16-19 de Julio de 2003.

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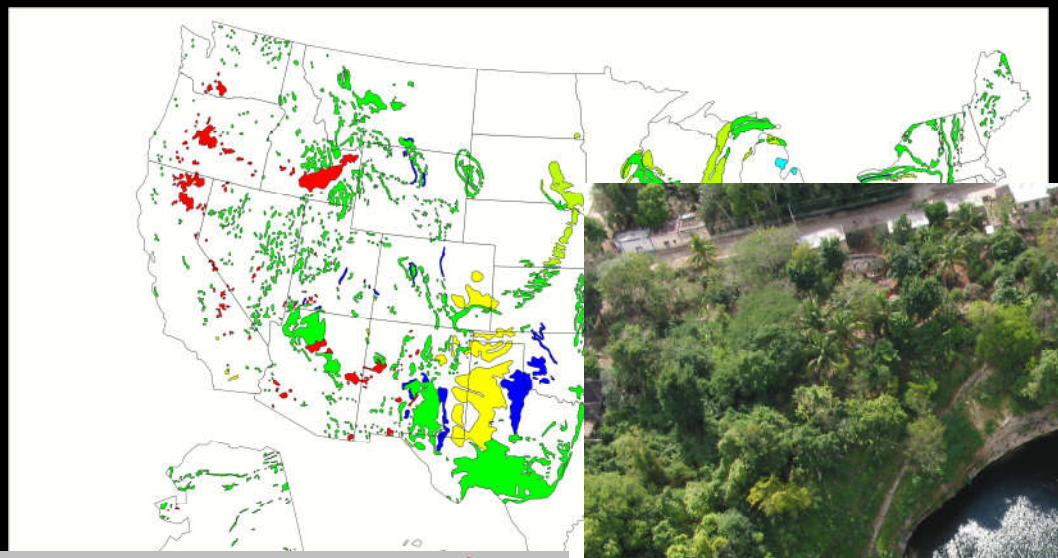
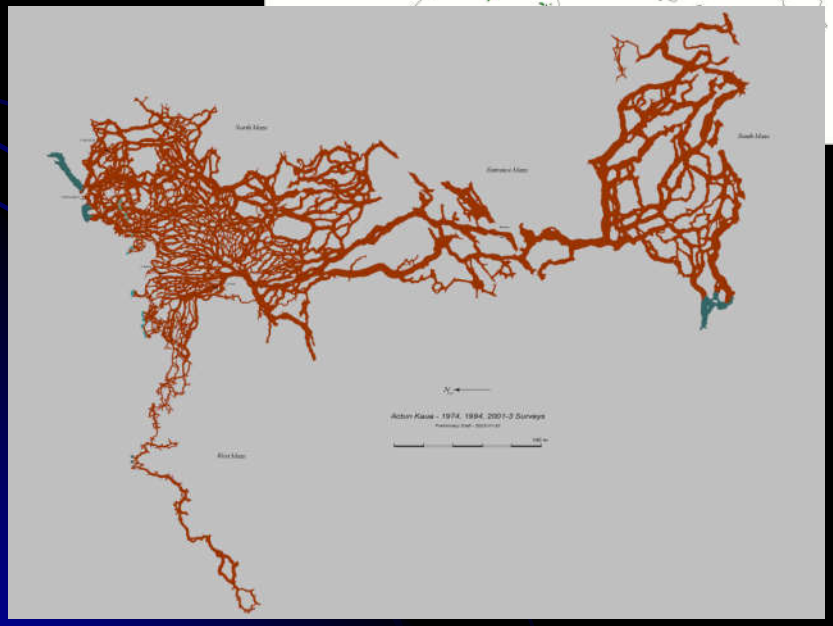
Hydrogeologic Research Methods for Karst Aquifers

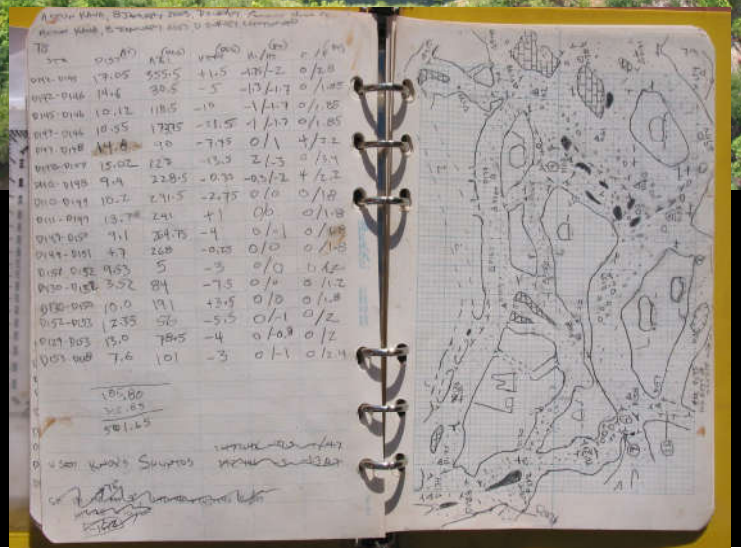
Geomorphological survey and assessment

Ideal first step for most studies and
where technology and logistics make other methods unfeasible

Determine if a database of caves and karst features exists for the project area



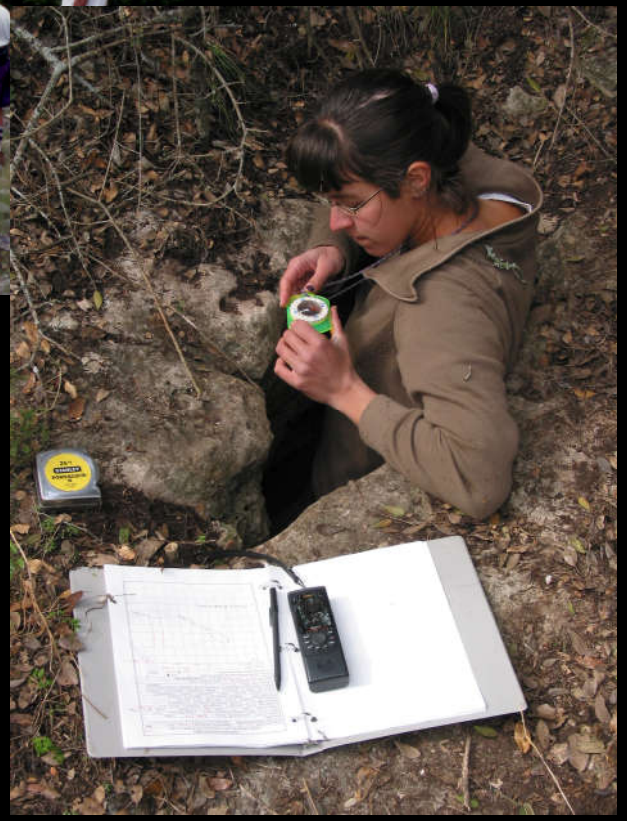




Conduct a field survey for caves and karst features

Survey & evaluate
surface & subsurface features

Geologically
assess all features



Analyze the karst feature database

Lithologic analysis

Structural analysis

Analyze the karst feature database

GIS analysis

Hydrologic analysis

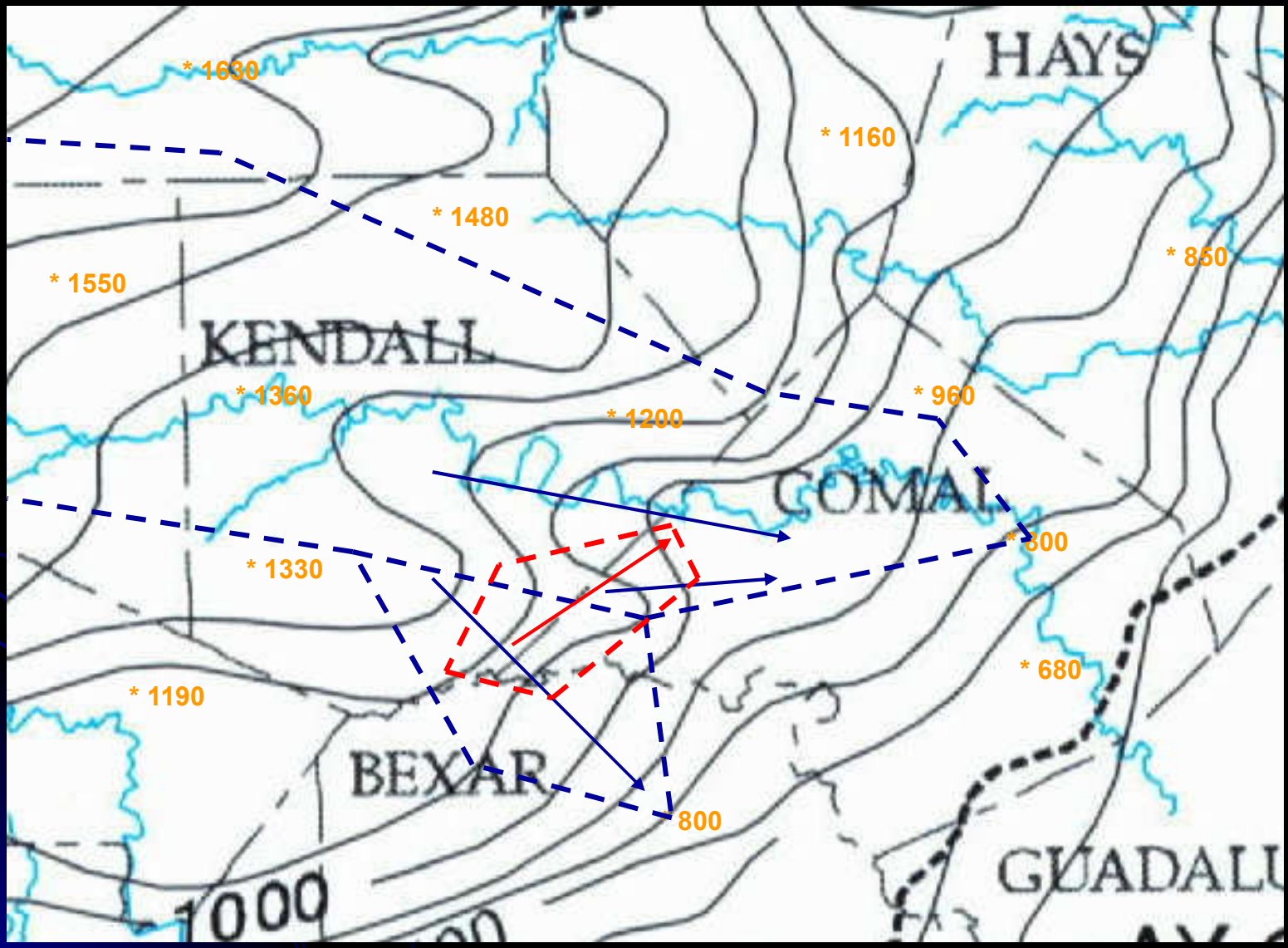
Epikarst analysis

Photo courtesy of Jason Pielemeier

Create an evolutionary model of cave and karst development in order to create a conceptual groundwater model

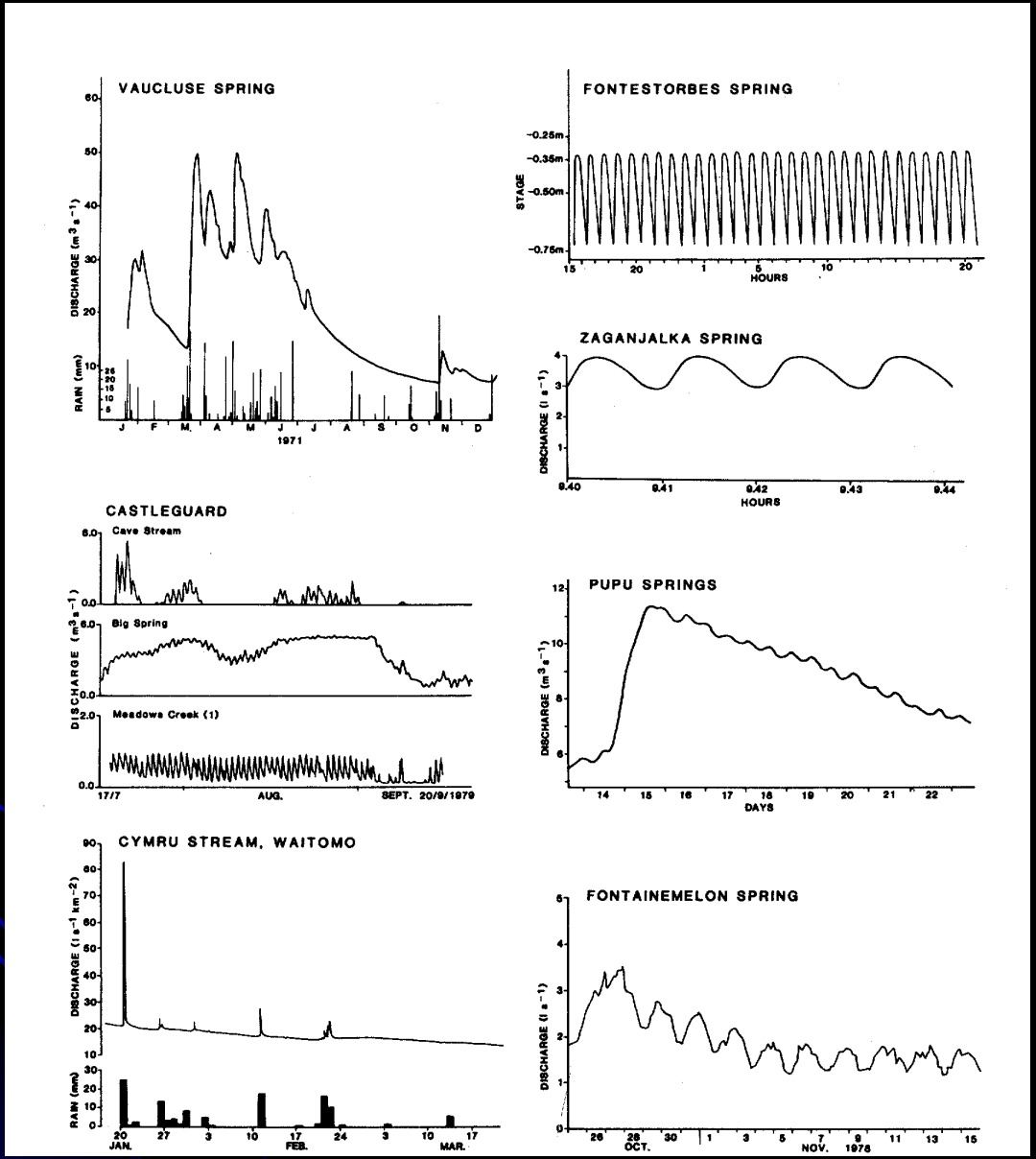
Modified from: MWH (2002)

Potentiometric mapping
Useful but not always completely accurate in karst



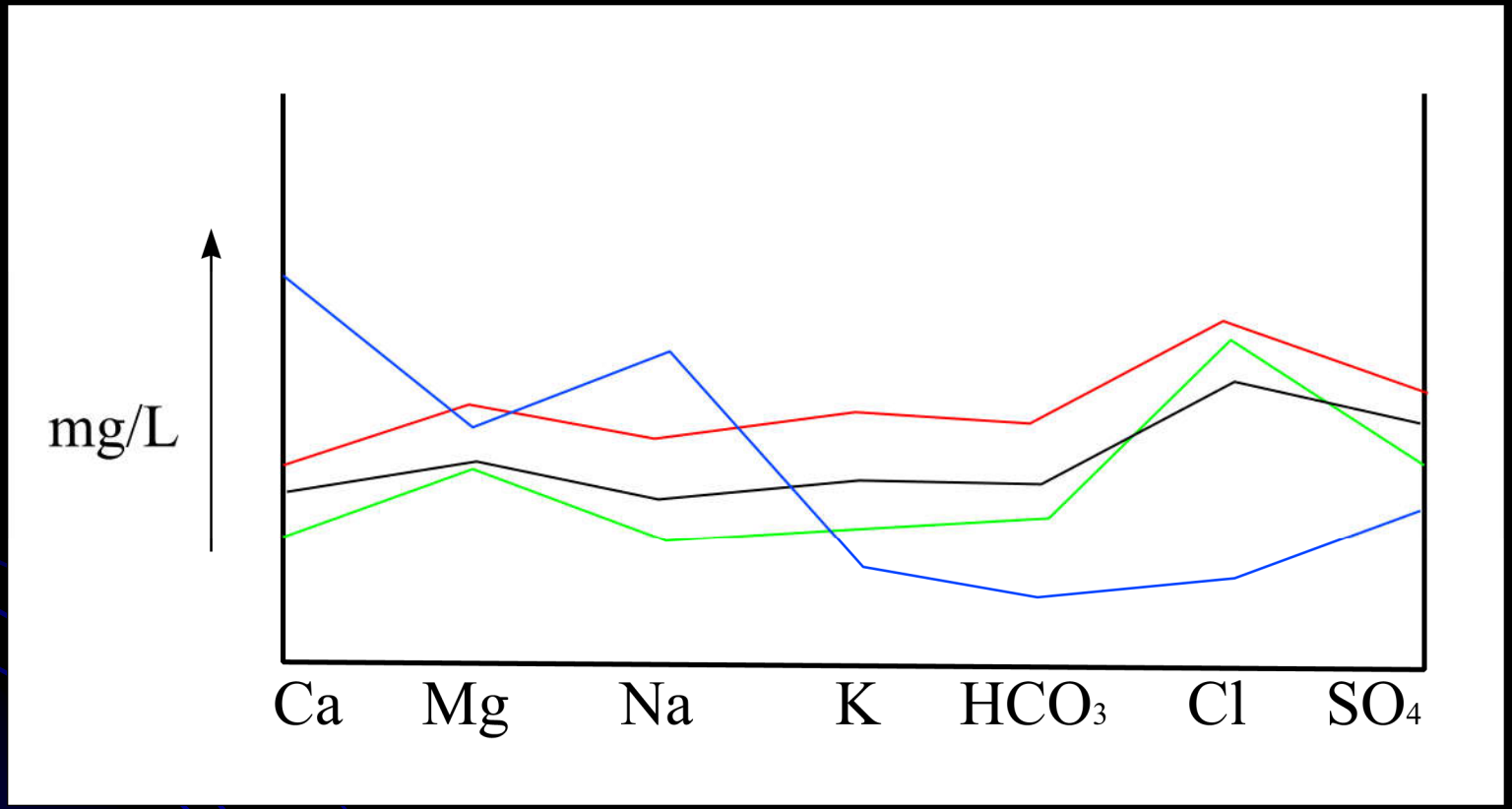
Modified from: *Hydrogeologic framework of the Edwards-Trinity Aquifer* (Barker & Ardis, 1996)

Use hydrographs to identify flow regimes and aquifer properties by well and springflow calculations



From: *Karst Geomorphology and hydrology* (Ford and Williams, 1989)

Hydrochemistry



Hydrochemistry

Details in the hydrochemical record are critical for accurate sampling of contaminants

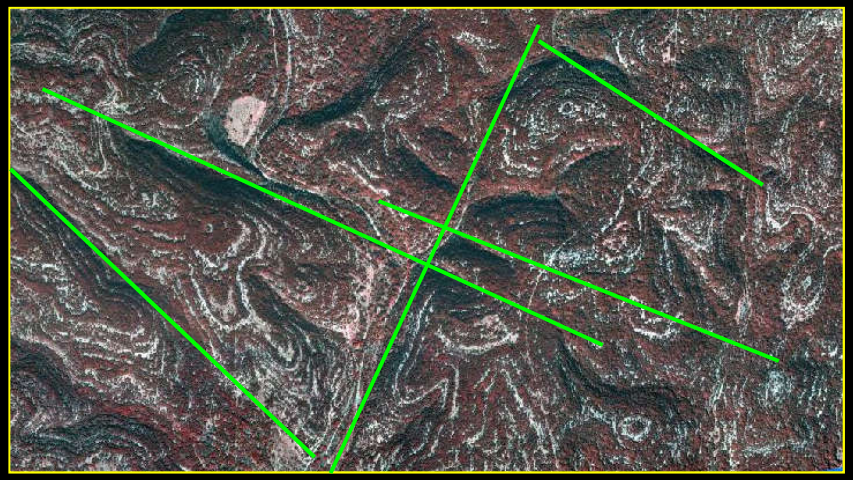
Contaminant geochemistry
Generally no plumes

Well monitoring inadequate

Drainage basin
mapping &
spring monitoring
needed

Remote sensing

Aerial photography



Lineament analysis

Thermal infrared mapping

Well logs

Void detection

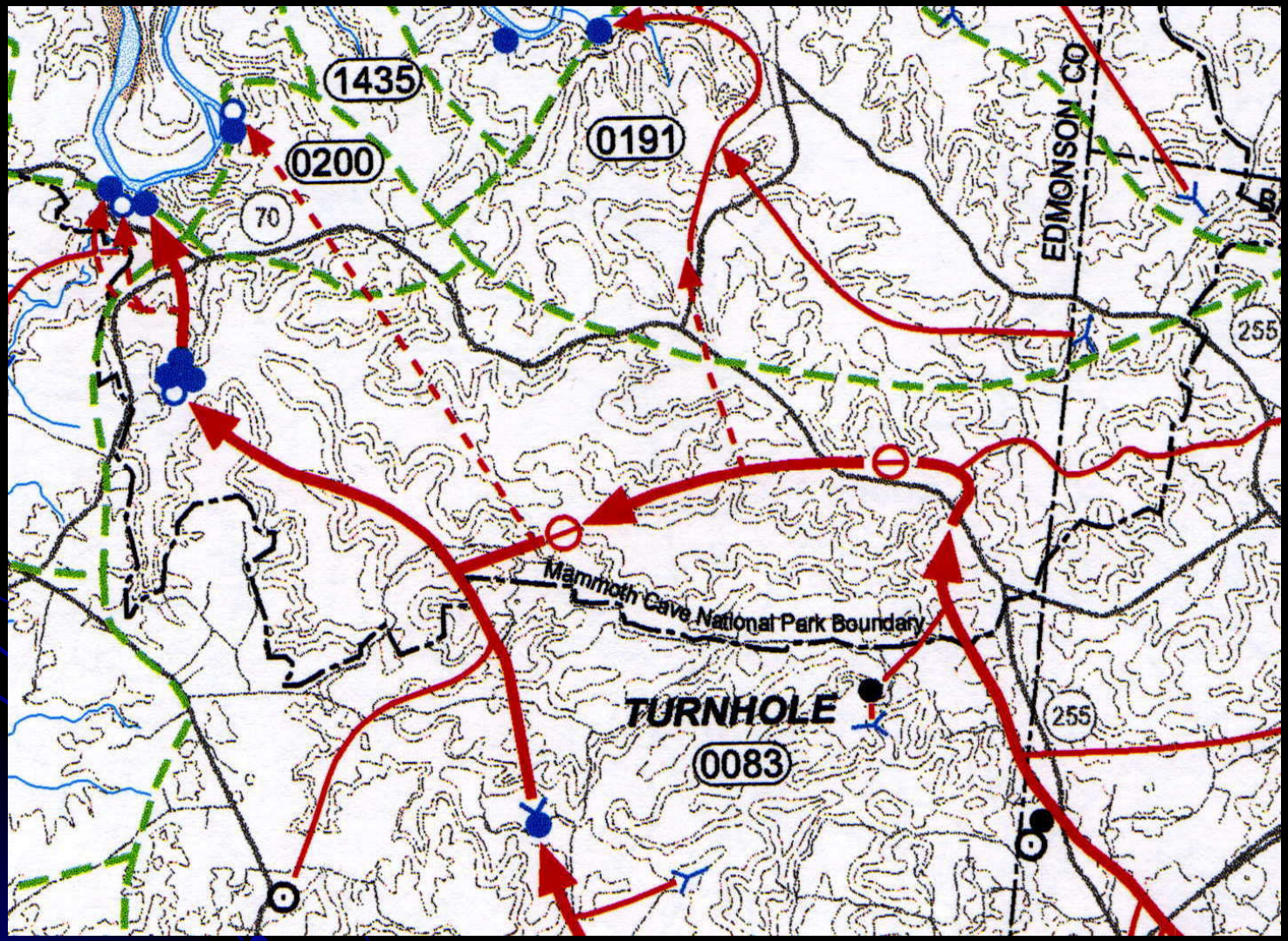
Ground penetrating radar
Natural potential/Spontaneous potential
Seismic

Electrical resistivity

Microgravity

Microgravity + Electrical resistivity

Tracer testing



From: Kentucky Geological Survey (2000)

Three primary types of tracers: contaminants, isotopes, and dyes

Characteristics of a good tracer:

low background
distinctive
easy to identify and measure
cheap
easy to acquire

Tracer Injection

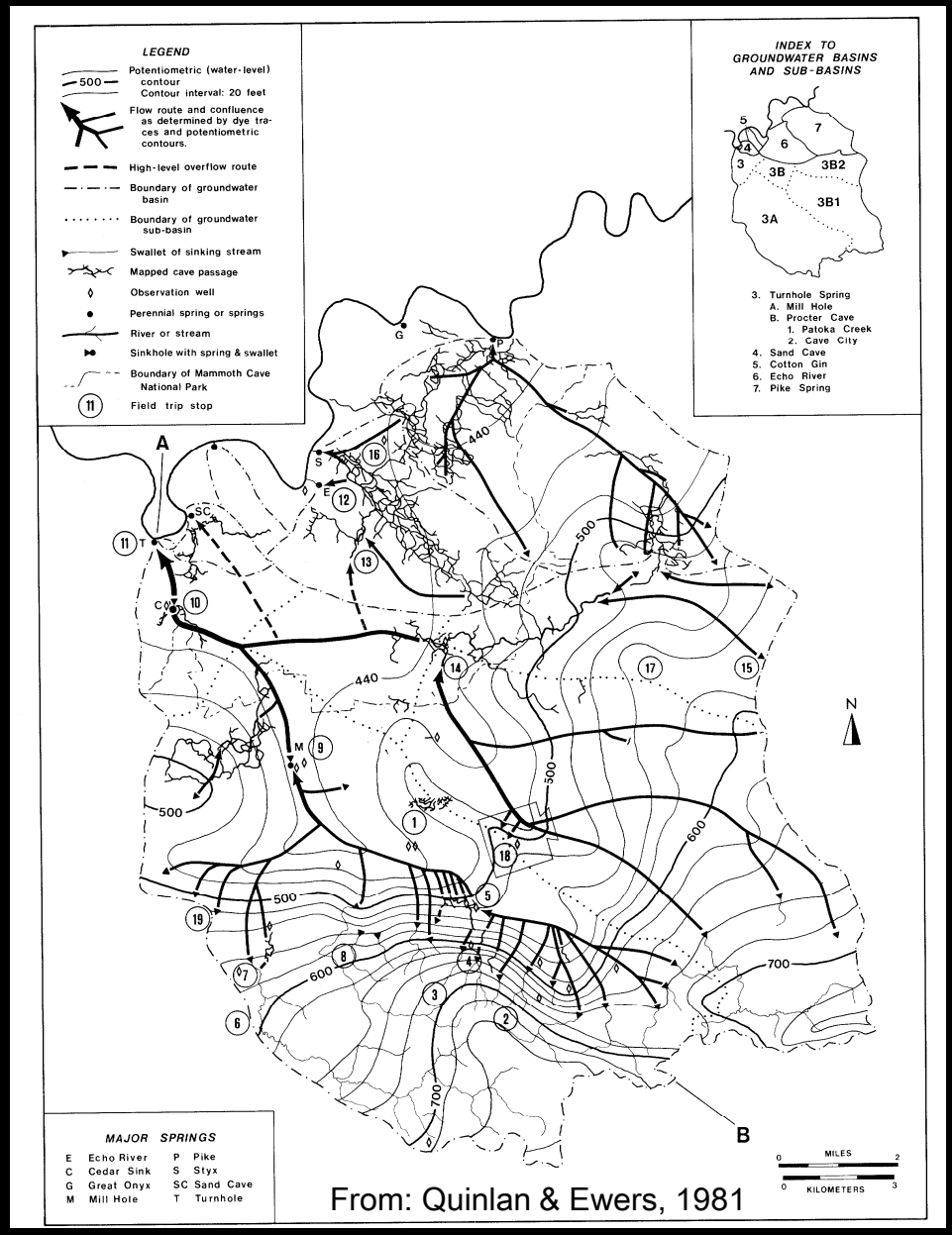
Detection
Where to look?
How to look?

Tracer test results

Aquifer flow routes

Aquifer parameters:

- Time of travel
- Time of travel at different flow conditions
- Dye dispersion
- Dye dilution



From: Quinlan & Ewers, 1981

Computer modeling

"One well-designed tracer test, properly done, and correctly interpreted, is worth 1000 expert opinions… or 100 computer simulations of groundwater flow."
James Francis Quinlan

Models currently work best in karst for large areas and deep aquifers

Cave biology research methods

Leave to experts unless properly trained
It is too easy to do more harm than good

Things you can do:

Count bats when they exit caves

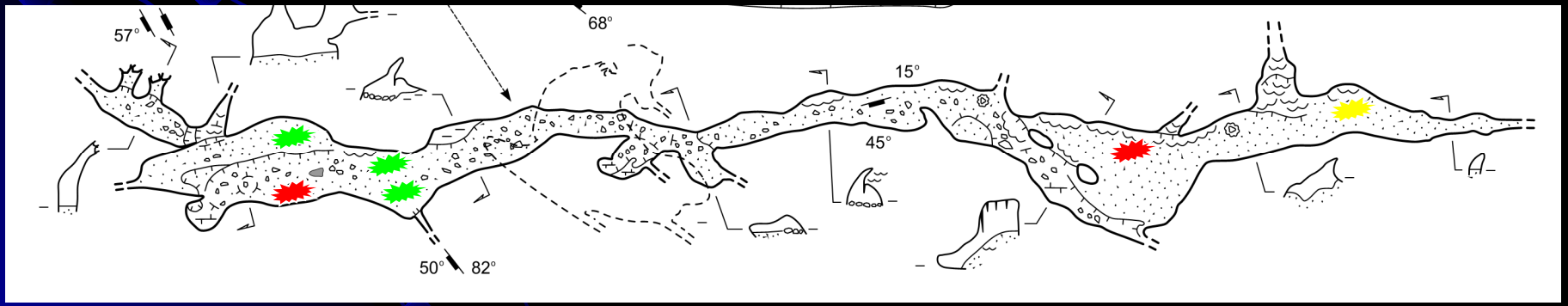
Report species observed and
the conditions where they were found

Collect species only if you have a specialist ready to identify them
and who gives you appropriate collecting materials

Show cave research methods

Monitor cave conditions

Impact mapping



Show cave research methods
Photo monitoring