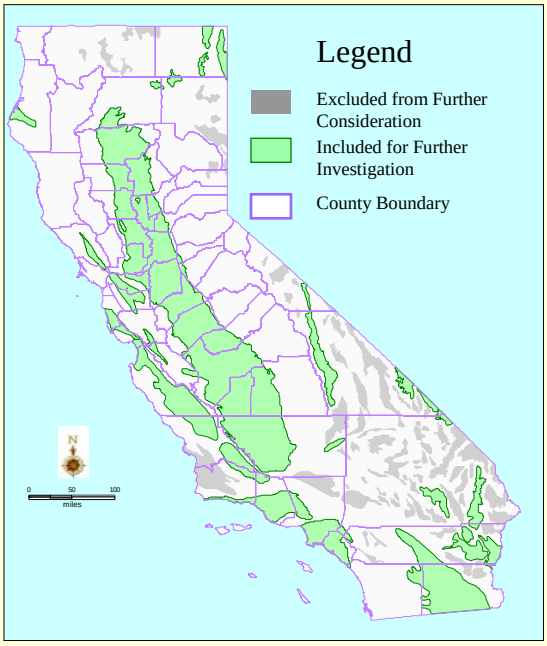
Geologic Sequestration of CO_2 in California

CGS
CALIFORNIA GEOLOGICAL SURVEY

Sedimentary Basin Evaluation

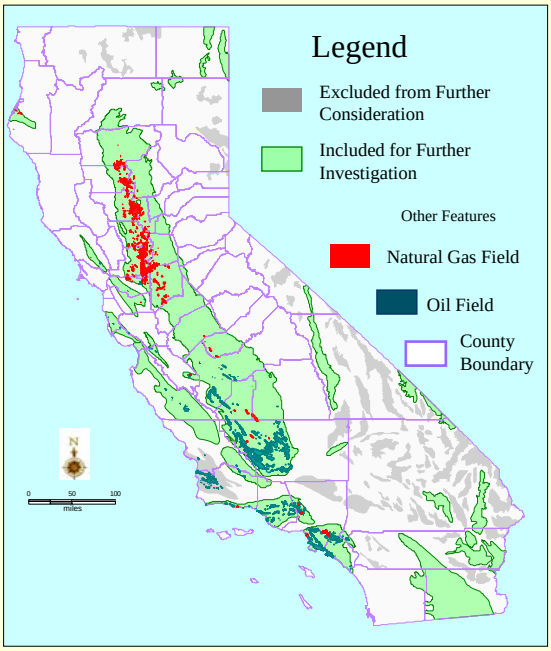
- 104 basins were screened
- 77 basins were eliminated from further consideration due to:
  - Lack of porous & permeable formations
  - Lack of suitable seals
  - Sediment thickness < 800 meters
  - Being within parklands, tribal lands, or military installations
- 27 basins met the initial screening criteria

Status of Sedimentary Basins In California



3

Sedimentary Basins, Natural Gas and Oil Fields in California



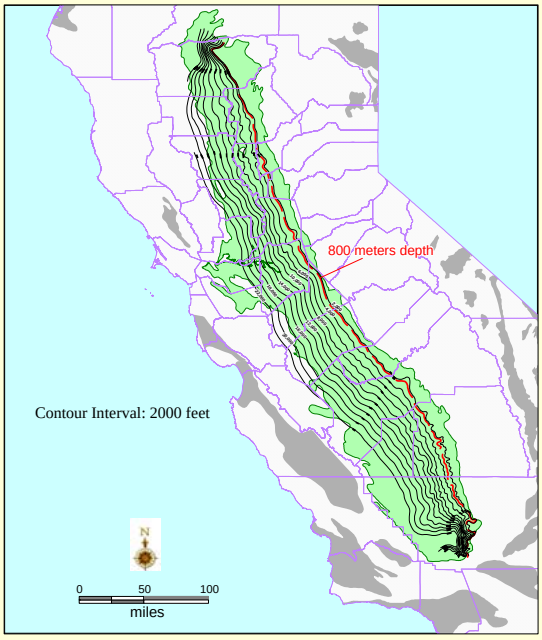
4

Sacramento and San Joaquin Basins

- Areally extensive (22,368 sq. mi.)
- Large sparsely populated areas.
- Tectonically stable (relatively)
- Depths from 800 meters (2,625 ft.) to > 12,200 meters (40,000 ft.)
- Abundant saline aquifers, oil & gas fields, and seals
- Good porosity & permeability (15-40%, 10-10,000 md)

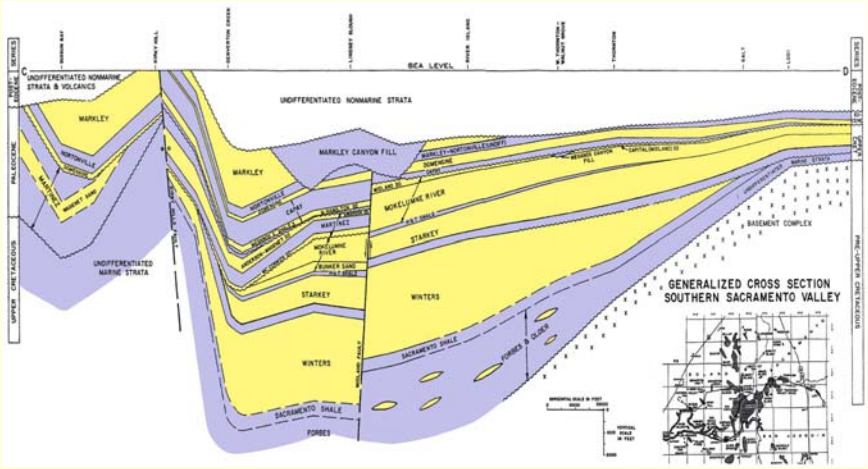
5

Depth to Basement, Sacramento and San Joaquin Basins



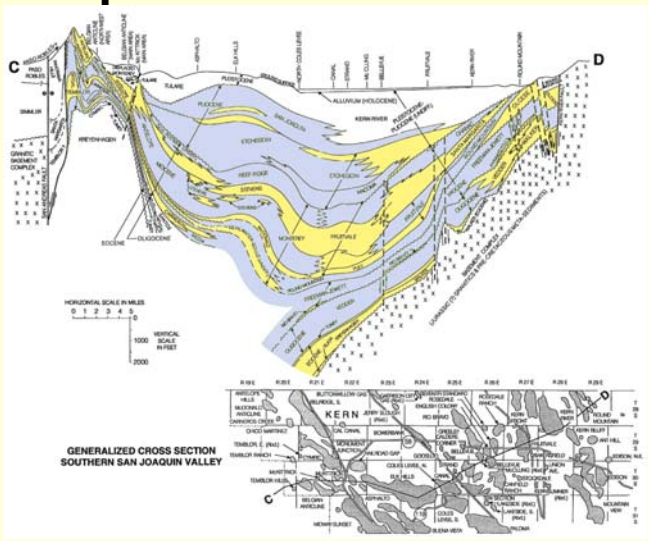
7

Generalized Cross-Section of Southern Sacramento Basin

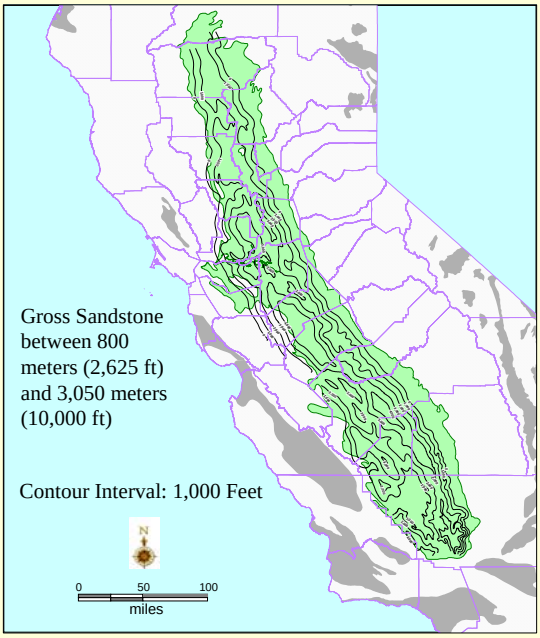


8

Generalized Cross-Section of Southern San Joaquin Basin



Isopach Map, Sacramento and San Joaquin Basins



9

Sacramento Basin Porosities & Permeabilities*

Cretaceous:	Forbes	(15 – 30%, 15 – 108 md)
	Lathrop	(18 – 27%, 60 md)
	Winters	(25 – 38%, 10 – 1,700 md)
	Tracy	(20 – 28%, na)
	Blewett	(20 – 30%, 70 – 597 md)
	Starkey	(14 – 35%, 50 – 100 md)
	Mokelumne	(15 – 35%, 250 – 1,500 md)
Eocene:	Domengine	(18 – 32%, 15 – 70 md)

* California Division of Oil, Gas, and Geothermal Resources

10

San Joaquin Basin Porosities & Permeabilities*

Eocene:	Gatchell	(14 – 20 %, 65 – 421 md)
	Kreyenhagen	(12 – 38 %, 10 – 4,950 md)
Oligocene:	Vedder	(12 – 40 %, 15 – 2,400 md))
Miocene:	Jewett/Pyramid Hills	(15 – 39 %, 6 – 5,000 md)
	Olcese	(20 – 34 %, 150 – 2,000 md)
	Temblor	(10 – 40 %, 7 – 10,000 md)
	Stevens	(10 – 35 %, 0.2 – 6,500 md)
	Santa Margarita	(20 – 40 %, 1 – 10,000 md)
	Chanac	(20 – 40 %, 1 – 10,000 md)
Pliocene:	Etchegoin	(12 – 40 %, 1 – 22, 320 md)
	San Joaquin	(28 – 34 %, 135 md)

*California Division of Oil, Gas, and Geothermal Resources

11

Conclusions – Phase I

- 27 basins with varying potential for CO_2 sequestration.
- Aggregate area of more than 38,000 square miles.
- Cenozoic marine basins exhibit most potential.
- Most promising geologically: Sacramento, San Joaquin, Ventura, Los Angeles, and Eel River basins.
- Storage estimates for 10 largest marine basins of 146-840 Gt CO_2 (Myer, et al, 2005).
- Detailed, formation specific mapping and characterization needed to identify pilot sequestration objectives.

10

CGS / WESTCARB - Phase II

- As part of the WESTCARB Phase II study, CGS is preparing isopach maps of specific formations and related overlying shales in the Sacramento Basin. These formations include:
  - The Starkey Formation
  - The Winters Formation
  - The Mokelumne River Formation

13

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11