



*Everglades Geological Society*

# **BULLETIN**

Volume 8, Number 4

December 2001

**Meeting This Month:** December 18, 2001  
6:00 P.M. at the French Connection Cafe  
(social hour starts at 5:00)

**Speaker:** W. Barclay Shoemaker,  
US Geological Survey  
Miami, Florida

Topic: Simulating Saltwater Intrusion in a Shallow Semi-confined Aquifer in  
Southwestern Florida

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*Everglades Geological Society*  
P.O. Box 61684  
Fort Myers, FL 33906

The Everglades Geological Society is an organization which seeks to promote interest in and understanding of Geology and the related Earth Sciences, and to provide a common organization for those individuals interested in geology and the related earth sciences. The Bulletin is a publication of the Everglades Geological Society, Inc.

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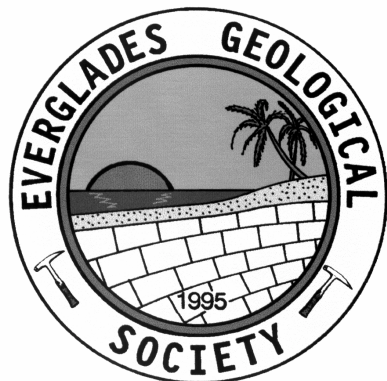
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**EGS MEETING THIS MONTH**  
**TUESDAY**  
**December 18, 2001**

**The French Connection Cafe**  
2288 First Street (at Jackson Street)  
Fort Myers, Florida  
(941) 332-4443

***Members Come Join Us!***

This winter's lineup of guest speakers are as follows and has been arranged by our Vice-President, Amy Tobias.

DATE	SPEAKER	TOPIC
12/18/01	Barclay Shoemaker USGS, Miami	Simulating Saltwater Intrusion in a Shallow Semi-confined Aquifer in Southwestern Florida
1/15/02	Philip Kramer University of Miami	to be announced
2/19/02	Tom Scott FGS, Tallahassee	Lake Jackson Sinkhole Explorations
3/19/02	Bob Baker Prosonic Corporation	to be announced
4/16/02	Sarah Kruse USF, Tampa	Ground Penetrating Radar

*~Note to Members~*

Sign-in sheets will be used at each meeting as attendance may be used for continuing education credits. Field Trip participation can also contribute continuing education credits.

***~ T-SHIRTS WILL BE AVAILABLE  
IN JANUARY~***

***FIELD TRIP JANUARY 19-21, 2002  
FGS- Tom Scott, Harley Means; Tallahassee, FL***

## PRESIDENT'S MESSAGE

By Jack Breland

[Dowserjac@msn.com](mailto:Dowserjac@msn.com)

Dear EGS members:

I would like to wish everyone Happy Holidays and hope that Santa brings plenty of rocks, minerals and fossils for all. I know this is a busy time of the year, but I hope everyone has a chance to come to this month's meeting to share in a little cheer and attend Barclay Shoemaker's presentation on a solute transport model of the Bonita Springs area. Barclay is a young upstart modeler from the USGS and should give a great talk.

Our club has a field trip scheduled for January 19, 2002, which is the Doctor Martin Luther King, Jr. Holiday weekend (3 days for government workers) and this trip is going to be great. All of those interested in going need to come to this month's meeting to hear more about it and to sign-up. Amy Tobias may be contacted at [tobiasae@cdm.com](mailto:tobiasae@cdm.com) to get the details. We need to work out the logistics of the trip and that is somewhat dependent on the number of people planning to go. We have Tom Scott and

Harley Means of the Florida Geological Survey to take us on a tour of karst features and outcrops in the Tallahassee area that are not commonly visited by the casual geologist. We will be meet them Sunday morning on January 20<sup>th</sup> at their office and leave from there. If you have a desire to get into some unfamiliar terrain and have a couple of Florida expert geologists describe the area for you, make plans to come along with us. We may be camping or hoteling depending on popular opinion.

Merry Christmas!  
See ya Tuesday.

Jack

***Our guest speaker for Tuesday December 18<sup>th</sup> is W. Barclay Shoemaker.***

### BIOGRAPHY

Mr. Shoemaker has a Bachelor of Science degree in Geology from Florida State University and a Master of Science Degree in Hydrogeology from the University of South Florida. His thesis work for the Master's degree is titled "Geophysical Delineation of Hydrostratigraphy in the Big Cypress National Preserve, Southwestern Florida". He currently is serving as a hydrologist for the U.S. Geological Survey, Water Resources Division, Miami, Florida studying saltwater intrusion in southwestern Florida, and developing a variable-density ground-water flow and solute transport process for MODFLOW 2000.

### ABSTRACT

Saltwater intrusion is observed in a  $5.2 \times 10^7$  to  $7.8 \times 10^7$  m<sup>2</sup> (square meter) area where the potentiometric surface of the lower Tamiami aquifer is below sea level in southwestern Florida. Density-dependent and uniform-density ground-water flow and solute-transport simulations are presented that (1) spatially quantify the seasonal water budget in 1996, (2) identify the processes of saltwater intrusion, (3) quantify the potential extent of saltwater intrusion and (4) quantify the relative influence of properties and processes on the extent of saltwater intrusion in the study area.

Two components of the water budget important to water-resource managers are net recharge and unmonitored ground-water pumpage. In 1996, net recharge and unmonitored ground-water pumpage are estimated to be 0.16 meters per year and 52,000 m<sup>3</sup>/d (cubic meters per day), respectively. Estimates of unmonitored ground-water pumpage were highly uncertain, as indicated by ninety five percent confidence intervals computed using the inverse modeling routine, UCODE, during model calibration. However, comparisons of simulated water levels, stream-flows and net recharge with field data demonstrate the empirical adequacy of the simulated water budget.

Using SEAWAT, the density-dependent ground-water flow and solute-transport simulator, potential processes of saltwater intrusion were identified as (1) lateral movement of the saltwater interface (2) upconing and (3) karst features or leaky artesian wells with communication to deeper aquifers. Saltwater intrusion through lateral movement of the saltwater interface occurs as saltwater beneath the Gulf of Mexico moves to equilibrium with contemporary stresses. A mound of ground-water head reaching elevations less than 1 meter above sea level prevented the saltwater interface from intruding the cones of depression farther inland. Saltwater intrusion through upconing occurs when natural upward leakage of ground water from deeper aquifers is amplified by ground-water pumpage in the lower Tamiami aquifer. Upconing explains most of the saltwater intrusion observed over the study area. Saltwater intrusion through karst features or leaky wells with communication to deeper aquifers can transport large quantities of saline ground water to the lower Tamiami aquifer because the potentiometric surface of the deeper Floridan aquifer system is about 10 meters higher than the potentiometric surface of the shallow semi confined lower Tamiami aquifer.

The potential extent of saltwater intrusion is about  $1.8 \times 10^8$  m<sup>2</sup> in the study area. The extent of saltwater intrusion is most sensitive to changes in recharge, followed by ground-water pumpage, sea level, salinity of the Gulf of Mexico and the potentiometric surface of the underlying sandstone aquifer, respectively. Data-collection efforts that improve estimates of these parameters and processes are most likely to reduce uncertainty in estimating the extent of saltwater intrusion near Bonita Springs.

### INTRODUCTION

Saltwater intrusion into coastal aquifers is a process that affects the quality and quantity of ground water available for potable supply. Despite many years of research and study, much uncertainty remains in understanding saltwater intrusion due to the difficulties in obtaining reliable estimates of hydraulic characteristics known to govern ground-water movement and to the inaccessibility of the saltwater transition zone. Problems related to saltwater intrusion that many scientists, engineers and water-resource managers must face include (1) determining if saltwater intrusion is occurring, (2) identifying the processes of saltwater intrusion, (3) determining the potential extent of saltwater intrusion and (4) determining which hydrologic characteristics or natural processes are important to accurately monitor in order to reduce the uncertainty in saltwater intrusion predictions. Site specific, quantified solutions to these saltwater intrusion problems were obtained for the shallow, semi confined lower Tamiami aquifer beneath Bonita Springs, Florida (figure 1) using numerical techniques.

## Everglades Geological Society

Meets on the Third Tuesday of each month at the French Connection Cafe on First Street in downtown Fort Myers, Florida. Social hour starts at 5:00 PM. The meeting begins at 6:00 PM. No meetings are held in July or August



### EGS MEETING CALENDAR 2001-2002

December 18

January 15

February 19

March 19

April 16

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