08:59:08 OCA PAD INITIATION - PROJECT HEADER INFORMATION 01/11/89

Active

Project #: [redacted] Cost share #: G-35-389 Rev #: 0
Center # : R6661-0A0 Center shr #: F6661-0A0 OCA file #:
Work type : RES
Contract#: [redacted] Mod #: Document : GRANT
Prime #: Contract entity: GTRC

Subprojects ? : N
Main project #:

Project unit: GEO SCI Unit code: 02.010.140
Project director(s):
[redacted] GEO SCI (404)894-2857
[redacted] GEO SCI (404)-

Sponsor/division name: [redacted] / GENERAL
Sponsor/division codes: 107 / 000

Award period: [redacted] to 900630 (performance) 900930 (reports)

Sponsor amount	New this change	Total to date
Contract value	80,000.00	80,000.00
Funded	80,000.00	80,000.00
Cost sharing amount		800.00

Does subcontracting plan apply ?: N

Title: [redacted]

PROJECT ADMINISTRATION DATA

OCA contact: Steven K. Watt 894-4820

Sponsor technical contact

[redacted]
(202)357-7866
[redacted]
[redacted]

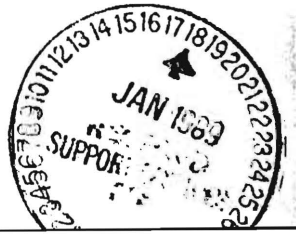
Sponsor issuing office

LEE A. DEHERRERA
(202)357-9621
NATIONAL SCIENCE FOUNDATION
DGC/AEO
WASHINGTON D.C. 20550

Security class (U,C,S,TS) : U
Defense priority rating :
Equipment title vests with: Sponsor
NO EQUIPMENT PROPOSED

ONR resident rep. is ACO (Y/N): N
NSF supplemental sheet
GIT X

Administrative comments -
PROJECT INITIATION



GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

NOTICE OF PROJECT CLOSEOUT

Closeout Notice Date 09/30/91

Project No. G-35-621 Center No. R6661-0A0

Project Director WEAVER C E School/Lab E & A SCI

Sponsor NATL SCIENCE FOUNDATION/GENERAL

Contract/Grant No. EAR-8816092 Contract Entity GTRC

Prime Contract No.

Title A PETROLOGIC & GEOCHEMICAL STUDY OF AUTHIGENIC/DIAGENETIC CLAY MINERALS..

Effective Completion Date 910630 (Performance) 910930 (Reports)

Closeout Actions Required:	Y/N	Date Submitted
Final Invoice or Copy of Final Invoice	N	
Final Report of Inventions and/or Subcontracts	Y	910930
Government Property Inventory & Related Certificate	N	
Classified Material Certificate	N	
Release and Assignment	N	
Other	N	

CommentsNO INVENTIONS PER PAD C.O. COMMENTS ENTERED WITH "Y". NSF LETTER OF CREDIT, NO HARD COPY INVOICE.

Subproject Under Main Project No.

Continues Project No.

Distribution Required:

Project Director	Y
Administrative Network Representative	Y
GTRI Accounting/Grants and Contracts	Y
Procurement/Supply Services	Y
Research Property Managment	Y
Research Security Services	N
Reports Coordinator (OCA)	Y
GTRC	Y
Project File	Y
Other	N
	N

NOTE: ~~Final Patent Questionnaire sent to PDPI~~.

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

NOTICE OF PROJECT CLOSEOUT (SUBPROJECTS)

Closeout Notice Date 09/30/91

Project No. G-35-621 Center No. R6661-0A0

Project Director WEAVER C E School/Lab E & A SCI

Sponsor NATL SCIENCE FOUNDATION/GENERAL

Project # A-8362 PD HUBBARD J L Unit 01.021.363 T
GRANT # EAR-8816092 MOD# MSTL *
Ctr # 24-6-R6661-000 Main proj # G-35-621 OCA CO MSH
Sponsor-NATL SCIENCE FOUNDAT /GENERAL 107/000
A PETROLOGIC & GEOCH
Start 890511 End 900630 Funded 13,000.00 Contract 13,000.00

LEGEND
1. * indicates the project is a subproject.
2. I indicates the project is active and being updated.
3. A indicates the project is currently active.
4. T indicates the project has been terminated.
5. R indicates a terminated project that is being modified.

G-35-621

PROGRESS REPORT FOR 1989

A PETROLOGIC AND GEOCHEMICAL STUDY OF AUTHIGENIC/DIAGENETIC CLAY MINERALS IN UPPER MISSISSIPPIAN PLATFORM-TIDAL FLAT CARBONATE ROCKS

Charles E. Weaver and Kevin C. Beck

Our major objectives were to determine if authigenic-diagenetic clay minerals occurred in limestones and, if present, determine the type of clays, their relation to the various carbonate facies, and their role in dolomitization. We have firmly established that clays grow spectuluarly in carbonate rocks. We are now proceeding on our other objectives, and some new ones.

We collected 150 samples of platform carbonate rocks from eastern Tennessee. Thin sections, residues, x-ray analyses have been made of all samples. SEM-EDX and K-Ar studies have been made on selected samples. We found that authigenic-diagenetic chloritic (expected) and illitic (unexpected) clays were relatively abundant in carbonate rocks ranging from tidal flat micrites to outer shelf oosparites and biosparites. In the latter two types, the clay minerals occur only in the ooids and fossil fragments and never in the cement. The clays have a variety of distribution patterns. Some of the clays are intimately associated with authigenic quartz, others with authigenic dolomite. K-Ar age data from the I/S indicate the clays formed only a few million years after formation of the carbonate minerals.

Clay is more difficult to observe in the micritic carbonates but corrensite and other varieties of chloritic material are invariably present, growing on dolomite rhombs. The chloritic nature of the clay increases with increasing dolomite/calcite ratio.

In order to check whether the Mississippian clay-carbonate association was an isolated phenomenon, samples were examined from an upper Ordovician oolitic limestone from eastern Tennessee. The ooids in these rocks were literally saturated with authigenic-diagenetic chlorite (Fe-rich). Some ooids are essentially spherical sponges of clay with calcite and ferrodolomite crystals in the voids, others have one to eight thin spherical layers of clay and in cross-section resemble an onion (see figures). Clay abundance is apparently related to stylolite formation as the clay content of the ooids systematically increases as stylolites are approached.

Most of the clay in the stylolites appears to be a concentration by pressure solution, of the clay in the ooids. Some of the clay appeared to grow early with crystallization continuing during stylolite formation, up until the pores were filled with cement. The early clay apparently filled voids created by boring organisms but later growth must involve some replacement of the carbonate ooids.

We have done some preliminary investigation of recent ooids from the Bahamas.

As we hoped, with these exploratory investigations, we have opened a whole new research area that will require many people many years to explore and interpret. The scope of the fields of clay mineralogy and carbonate petrology will be significantly broadened.

Next year we hope to complete the study of the upper Ordovician Fe chlorite ooids. These may be related to the origin of chamosite and oolitic Fe ores. We will continue our systematic study of the Upper Mississippian tidal flat-platform carbonates and refine the clay type-environmental relations. We will spend some minor time looking at Recent ooids.

We have enclosed a few pictures to illustrate the type of clay-carbonate textures we are finding. The type of investigation we are doing requires a great deal of SEM-EDX study. For this reason, we are requesting an additional $5,000 (plus overhead) to be used entirely to pay for SEM-EDX time. Also note our Fringe Benefits and Indirect Costs have increased slightly.

G-35-621 NSF

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Part II - Summary of Completed Project

The objectives were to develop techniques to examine clays in carbonate rocks and determine if these clays were digenetic (as opposed to detrital). The study was conducted primarily with the Scanning Electron Microscope which was used to study the acid etched surfaces of the rocks. Authigenic (or digenetic) clay minerals were found in carbonate rocks from all 13 formations examined. Two formations were examined in detail. In one the source of the ions was water from the surrounding clay muds (now shales), in the other, the ions were internally generated. The clay minerals found were, Mg-chlorite, Fe-chlorite, corrensite, Ch/S, illite and illite/smectite. This study opens a whole new research area for carbonate petrographers and geochemists. Among other things, it provides a mechanism for determining the composition of fluids during deposition and/or burial digenesis and determining the time of migration, using K-Ar dating techniques.

Part III - Technical Information

We have examined samples from 13 formations, two in detail. We accomplished our major objective, which was to explore and establish whether authigenic/diagenetic clay minerals were a common component of carbonate rocks and whether they could be successfully studied. They are there; they can be associated with unique micro-mineral suites; Mg-clays (expected), K-clays (unexpected), and Fe-clays (unexpected) are common.

Future studies promise to provide a wealth of information, probably more for the carbonate petrologists, aqueous geochemists, basin modelers, and petroleum geologists, than for the clay mineralogist. But it is the latter group, who will have to supply the basic detailed data.

A paper entitled "Neoformed Physils in Ordovician Ooids" has been accepted by the J. of Sedimentary Petrology.

A review-type paper on clays in carbonate rocks was given at the October 1990 meeting of the Clay Mineral Society Meeting. Weaver, C.E. Beck, K.C., and Carr, M.K., "Physils Also Grow in Carbonate Rocks".

Martha Carr will finish her thesis on the geochemical significance of physils in the Monteagle formation (Upper Mississippian) this summer.

In addition to the three people listed above, Dr. R.L. Folk has assisted with the petrography, Dr. J.M. Wampler with the K-Ar analyses and Dr. J.T. Sparrow and J.L. Hubbard with the SEM=EDX and electron probe analyses.