A B S T R A C T

A detailed sedimentologic study of the Vempalle Formation, the oldest carbonate unit in the Middle Proterozoic Cuddapah Supergroup in parts of Andhra Pradesh, was undertaken.

Six stratigraphic sections, at Nandimandalam, Vempalle representing Papaghni river section, at Brahmanapalle midway between Pulivendla and Parnapalle, at Parnapalle (Chitravati river section) and at Peddapappuru and Chagallu representing Penner river section were carefully measured and sampled.

Detailed petrographic studies of the Vempalle Formation involved the examination of about 300 thin sections under the microscope, supported by etched polished blocks and acetate peels, partial chemical analyses by EDTA methods, Electron microprobe analysis of representative samples, from various lithofacies for major and minor elemental distribution and mineralogy of the various lithofacies by X-ray diffractometry and biological studies of the chertified portions of the stromatolitic facies under oil immersion lenses.

Further based on field relations and primary sedimentary textures and structures the Vempalle Formation could be divisible into the following broad lithofacies and their further sub-division of the lithofacies into lithotypes (texture types) is primarily based upon thin section petrography. The broad lithofacies and their associated lithotypes may be summarized as follows :

Lithofacies	Associated lithotypes
1. Structureless lime mud facies	Micrite/microsparite, dismicrite/ 'structure grumeleuse' - microsparite/ quartz and feldspar bearing micrite/ microsparite.
2. Stromatolitic lime mud facies	Micrite/microsparite, coated grains with micrite envelopes, within laminae, in places, micro brecciated.

Lithofacies	Associated lithotypes
3. Oolitic facies	Oomicrosparite with lesser oosparite with interooid matrix containing clotted pelletoids (neomorphic after spar) and scarce intraclasts.
4. Limeclast conglomerate	Intrasparite and intraoosparite with, occasional well lithified, well laminated clasts, derived from reworking of earlier well lithified sediment. Stray ooids in the matrix.
5. Shale	Fine grained, variegated grey and pink colours.

All the lithofacies are interbedded with each other, quite intimately in vertical successions. Upward transition matrix analysis following Till (1974) bring out the essentially cyclic nature of deposition of the various lithofacies. Basically two cycles were recognisable :

(1) Transgressive - lime mud/stromatolitic lime mud ---> oolite ---> shale,

(2) The regressive - lime mud/stromatolitic lime mud --> shale --> oolite, with clast conglomerates appearing randomly any where in the cycle.

Because of the intimately interbedded nature of the basic lithofacies and in the absence of any visible breaks or marker horizons in the stratigraphic record of the Vempalle Formation, stratigraphic sub-divisions of the Formation becomes artificial and correlation of individual facies almost impossible. Hence lithostratigraphic correlation based on energy index logs has been attempted following the procedures of Plumley and others, 1962 and Ghose, 1981. The energy index logs, prepared for all the measured sections indicate no abrupt changes in the variation of bottom energy conditions despite the fact that each lithofacies has its specific, energy level. Further the fairly uniform bottom energy conditions, throughout the Vempalle deposition, points out to the essentially tectonic stability of the depositional site (Cratonic platform facies). Energy cycles have an average thickness of 40 m and they are broadly correlatable.

Partial chemical analyses and mineralogy by X-ray diffraction methods point out that a majority of the lithofacies are Mg dolomites and that the predominant mineral phase is dolomite. Electron microprobe analysis for major and minor elements (Ca, Mg, Si, Al, Fe, Sr, Ba, Pb, Mn) generally lend support to the above conclusion. However, Sr in stromatolitic and oolitic facies shows distinctive distribution. The element, despite some loss during diagenesis and dolomitization, is enriched in oolitic facies (0.35 wt.%) in contrast to the stromatolitic facies (0.12 wt.%) reflecting possibly their original mineralogy : the oolitic facies (aragonite) and stromatolitic facies (calcite/Mg-calcite).

The various lithofacies exhibit several distinctive inorganic (primary and secondary) and organo sedimentary structures (stromatolites of different types) as given below :

Facies	Sedimentary structures	Environment
1. Lime mud	(i) Even horizontal lamination, that is often algal, desiccation cracks.	Supratidal
2. Stromatolitic lime mud	(i) Stromatolites of different types (LLH, SH, and SS, rare Conophyton of which the first two predominate).	Intertidal to shallow subtidal
	(ii) Compound stromatolites (biohermS).	
	(iii) Simple algal laminations	
3. Oolitic facies	(i) Cross-bedding (planar, trough and herringbone types).	Intertidal, tidal channels and shallow subtidal
	(ii) Symmetrical ripple marks	

From all evidences presented so far, the most probable environmental model for the Vempalle Formation, has been envisaged to be a shallow near shore broad tidal flat (supratidal, intertidal, shallow subtidal) of an epicontinental sea. The prevalent environment must have been uniformly arid.

The specific environments and associated lithofacies/lithotypes may be broadly summarized thus :

Environment	Lithofacies/lithotypes and associated sedimentary structures
1. Supratidal	Lime mud facies : Thinly laminated micrite, structureless micrite with quartz and feldspar, dismicrite with bird's eye structures, extensive desiccation cracks.
2. Intertidal	Stromatolitic facies : Laminated micrite with LLH, SH structures dominating, oomicrite/ microsparite, crossbedded (planar, trough and herringbone types, the latter predominating) possibly deposited in tidal channels cutting across intertidal mud flats. Intraclast conglomerates as basal lag deposits.
3. Shallow subtidal/shelf	Oolitic and intraclast conglomerates and stromatolitic biohermal facies : Stromatolitic micrite with SS and large stromatolitic bioherms in slightly deeper portions of the shelf. Intraclast conglomerate, ripple crossbedding, wave ripple marks planar and trough crossbedding in oolitic facies, shales.

Dolomitization is all pervasive and affects all lithofacies without any exception and is regarded as early diagenetic. The process of dolomitization was considered to be mainly refluxion (seepage and evaporitic reflux) brought on by the generally prevalent arid climate.

Chertification of the lithofacies is also prevalent, but this process is selective and chert nodules occur in the lithofacies quite randomly. Because of the presence of algal cells and filaments (probably both eukaryotic and prokaryotic affinities) preserved in them, chertification too, is regarded as early diagenetic, before the microbiota were crushed and destroyed by the overburden.