PREFACE

Scientific analysis of mural paintings is an important field of research in conservation science. A detailed investigation about the discovery of Ajanta along with acts carried by various art lovers that has direct bearing on survival of Ajanta murals is carried out. The art and architecture of Ajanta was investigated along with nearby Buddhist sites with scientific data in support of chronology of Ajanta. Mural art technique of Ajanta vis-à-vis ancient Indian painting recipe has been studied in detail. The impact of visitors on Ajanta murals has been studied for the first time along with variations of temperature, humidity, noise level, insect activity, carbon dioxide, light etc on the painted plaster. A detailed investigation about the pigments and mud mortar is required so as to prepare a matching repair mortar for restoration. Characterization of materials and mural art technique helped in understanding Ajanta murals for execution of restoration work with similar materials for posterity.

The cross sectional studies of the painted plaster were carried at the site as well as in the laboratory with FTIR and SEM techniques. Portable XRF was used as non-destructive technique for the analysis of pigments of Ajanta and few micro grains were also investigated through FTIR, Raman & SEM methods. The mud plaster samples were analyzed for particle size, petro-logical analysis, XRF, XRD, FTIR, Raman and SEM. For monitoring environmental parameters and study on carrying capacity of cave murals of Ajanta thermo-hygrograph, Lux meter, protimeter, carbon dioxide analyzer, noise meter etc. were used. A detailed literature survey was carried out about the past conservation treatment. Based on the feedback newer techniques were developed for cleaning of paintings. Matching repair mud mortar mix was prepared for filling the gaps, lacuna etc. in the painted plaster based on ancient techniques and analytical data.

This thesis consists of 4 Chapters. Chapter 1 gives an introduction to the Ajanta paintings; deals with literature survey, ancient painting recipe, discovery of Ajanta murals, art and Architecture of Ajanta along with scope and importance of this kind of study.

Chapter 2 consists of the materials and methodology applied in the present work. In this section, the collaborative studies undertaken at Ajanta are also presented.

Chapter 3 incorporates the results and discussion of the findings on experimental observation for preservation of mural art at Ajanta. This chapter is further divided into
sections from A to F, each section contracting with analytical results and conservation methodology adapted to maintain Ajanta murals.

**Section – A** explains the condition of murals of Ajanta caves. This section also shows the previous conservation studies and measures carried out at Ajanta. This section also elaborates the true condition of caves and its paintings at the time of discovery.

**Section – B** deals with the scientific analysis carried out on the pigment of Ajanta mural paintings by both non-destructive and destructive techniques such as XRF, XRD, FTIR, Raman Spectroscopy and SEM. It is evidenced from the study that the paint layer has been applied on the dry plaster with pigments of inorganic nature.

**Section – C** presents the analysis of Lime/mud mortar for consolidation of Ajanta mural paintings carried out through particle size analysis, X-ray florescence spectroscopy, X-ray diffraction studies, Fourier transform infrared spectroscopy and Scanning electron microscope. It is observed that sandy loam soil from Waghura river bed were probably used for preparation of mud mortar and its properties modified with the use of lime, organic plants, fibres and seeds. The characterization has helped in the development of new material for restoration having identical performance and compatibility as of original.

**Section – D** highlights the scientific studies for the execution technique of Ajanta mural art. The mud mortar and paint layers have been investigated using the analytical tools as Scanning electron microscope, FTIR, Raman Spectroscopy. The studies are of great importance in planning future conservation measures of Ajanta murals and understanding of execution technique. The comparative investigation highlights that the pigment used in Indian paintings remained almost same.

**Section – E** section describes the causes of deterioration of murals of Ajanta by monitoring environmental parameters such as temperature, humidity, light intensity, dust and dirt. This section also outlines the visitors impact vis-à-vis physical measures adopted for the long term survival of Ajanta murals. The impact of light illumination, dirt and dust on murals is also highlighted.

**Section – F** deals about the detailed conservation and preservation of mural paintings. In this section some new approach to the conservation of mural art of Ajanta has been highlighted along with the use of two component system for cleaning for the first time. The
conservation measures carried out for stabilizing and scientific cleaning of the paintings have also been outlined here along with entomological studies.

Chapter 4 summarizes all the works discussed in the previous chapter (Sections A – F) and provides a feasible future outlook.