PAPER PROPERTIES AND DEGRADATION

(Modified from the article "Recent Scientific Research in Paper Conservation" by Dianne van der Reyden, in The Journal of the American Institute for Conservation, Vol. 31, pp. 117-138, 1992)

INTRODUCTION:

In 1988, the American Institute of Conservation (AIC) requested the first Paper Conservation Update. The first update reviewed scientific investigations into five important paper conservation treatments: encapsulation, fumigation, washing, deacidification, and bleaching (Kruth 1988). Research published since then continues to add to the body of knowledge about these and other treatments, as well as to shed light on the relationship of treatments to paper properties and the aging of paper (Robb 1991). Paper conservators are increasingly concerned about the long-term effects of treatments on the chemical and physical properties of all the components of the paper composite, including the fibers, fibrils, and cellulose polymer chain (Fig. 1). Consequently, this second update, requested by AIC in 1991, briefly summarizes scientific research pertinent to these concerns. To provide the context in which to evaluate paper conservation research, it is necessary to first outline research regarding paper properties and the aging of paper. This is followed by a synopsis of recent findings about paper conservation treatments involving washing, bleaching, solvents, enzymes and sizing. Because of space restrictions, the information below is highly selective and condensed, and represents only a small portion of the research data. The reader is urged to consult the cited references for more details and additional findings.

"The evaluation of scientific results and recommendations in conservation literature is greatly aided by a good understanding of the rationale behind the selection of test materials and methods." (Burgess and Binnie 1990, p. 133)

An understanding of the rationale behind research design is enhanced by a knowledge of paper properties and their reaction to relative humidity, temperature, radiation, and pollution. These environmental factors initiate degradation mechanisms of hydrolysis, oxidation and crosslinking (Table I). These degradation mechanisms can be detected by various tests (Table II). Such tests measure 1) chemical, 2) physical, and 3) optical properties of paper. The following summary presents a few basic terms and concepts relevant to these properties.