

DETERIORATION OF DEAD SEA SCROLLS INVESTIGATED BY SOLID STATE AND UNILATERAL NMR; EFFECTS OF SOLVENTS ON COLLAGEN-WATER SYSTEM

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This work concerns a study of a series of samples of a Dead Sea parchment treated with various solvents to an adequate solvent for conservation treatments. The unique properties of old parchments require a systematic approach based on analytical techniques able to obtain the maximum amount of information from a rather small sample. Present results were obtained by high resolution solid state nuclear magnetic resonance (HR SS NMR) and unilateral nuclear magnetic resonance (NMR MOUSE) measurements. Measurable physico-chemical properties were used for the quantification of parchment deterioration and characterisation of effects of various solvents on hydration of collagen molecule within Dead Sea Scroll. For this purpose, protocols for damage assessment were proposed and satisfactory solvents for conservation treatments were identified.

Unilateral NMR analysis was performed by means of a new portable non invasive and non destructive device, NMR-ProFiler, based on relaxation time measurements by spin-echo sequences. In the case of parchments NMR T1 relaxation times of hydrogen nuclei of water in the sample are measured. Preliminary results show that T1 relaxation time values could be used to qualitatively assess the changes of collagen structural water environment. Thus, measurement of NMR absorption in the “collagen-water” system could provide a non-invasive, discriminative and sensitive tool for the study of the effects of deterioration factors on the organization of water within the collagen structure. All results obtained by mean of portable device have been confirmed by HR SS NMR spectroscopy.