"Film Preservation for an Academic Collection" CARLI Workshop

October 13, 2009

Care, Handling and Storage of Motion Picture Film On-line resources

COOL: Conservation On-Line
http://cool.conservation-us.org/bytopic//motion-pictures/

Library of Congress
www.loc.gov/preserv/care/**film**.html

> Care, Handling and Storage of Motion Picture Film
> A basic discussion aimed at the general public.
>
> The Library of Congress Motion Picture Conservation Center
> A brief history.
>
> Motion Picture Conservation at the Library of Congress by David Francis
> A description of the restoration process.

Film, Preservation and Cultural Organizations
http://www.loc.gov/film/orgs.html

Film Forever

The objective of this web site is to provide simple guidelines for preserving motion picture film materials outside of specialized archives, with a focus on storage at home.

http://www.filmforever.org/

National Film Preservation Foundation (NFPF) is the nonprofit organization created by the U.S. Congress to help save America's film heritage. They support activities nationwide that preserve American films and improve film access for study, education, and exhibition.
http://www.filmpreservation.org/

> The Film Preservation Guide

The Film Preservation Guide: The Basics for Archives, Libraries, and Museums describes methods for handling, duplicating, making available, and storing film that are practical for nonprofit and public organizations with limited resources. It traces the path of film through the preservation process and includes case studies, illustrations, charts, glossary, bibliography, vendor lists, and index. The Film Preservation Guide was honored by the Society of American Archivists with its 2005 Preservation Publication Award.

Free copies of this 138-page illustrated publication can be **downloaded** chapter by chapter or as a complete text. You can also order the printed book by mail..

Organizations:

AMIA

AMIA is a non-profit professional association established to advance the field of moving image archiving by fostering cooperation among individuals and organizations concerned with the acquisition, description, preservation, exhibition and use of moving image materials. (has a list-serve and a National Conference. Valuable work-shops for preservation)
http://www.amianet.org/

From AMIA links to eternal information

Archival Storage and Management
Archives, Libraries, and Museums
Associations and Organizations
Digital Film and Video Restoration
Educational Programs
Magnetic Tape Restoration
Media Asset Management
Motion Picture Film Laboratories
Motion Picture Studios , Television Networks, and Production Companies
Sound Restoration and Technology
Stock Footage and Stills
Supplies, Service, and Equipment
Other Institutional Members

Archival Storage and Management

A listing of film supply and equipment vendors.

Action Camera (San Francisco)
www.actioncamerasf.com
Discount film, equipment & supplies

Archival Methods
www.archivalmethods.com
General archival supplies

Christy's Editorial
www.christys.net
Equipment

Dancan
www.dancan.dk
16mm cans, cores, supplies

Gaylord
www.gaylord.com
General archival supplies

Hunt's A-V (Boston and Providence)
www.huntsphotoandvideo.com
800-924-8682
Supplies (Gepe reels, more)

IPI (Image Permanence Institute)
www.imagepermanenceinstitute.org
A-D strips and free preservation calculator download
Information and products

Kodak
www.kodak.com
Information and products including molecular sieves

Light Impressions
www.lightimpressionsdirect.com
General archival supplies

Metal Edge
www.metaledgeinc.com
General archival supplies

MPE (Motion Picture Enterprises)
www.mpe.net
212-245-0969
8mm & 16mm cans and reels

Neumade Corporation
www.neumade.com
Cans, cores, reels.

Phil's Vintage Movie Films & Collectibles
www.8mm16mmfilmscollectibles.com/supplies
Small gauge supplies including leader, presstapes, rewinds.

PRC (Plastic Reel Corp. of America)
16mm cans
(no web site)
201-933-5100

StilDesign (Canada)
www.StilDesign.com
Archival cans & cores

Spectra Film & Video
www.spectrafilmandvideo.com/Products.html
film supplies

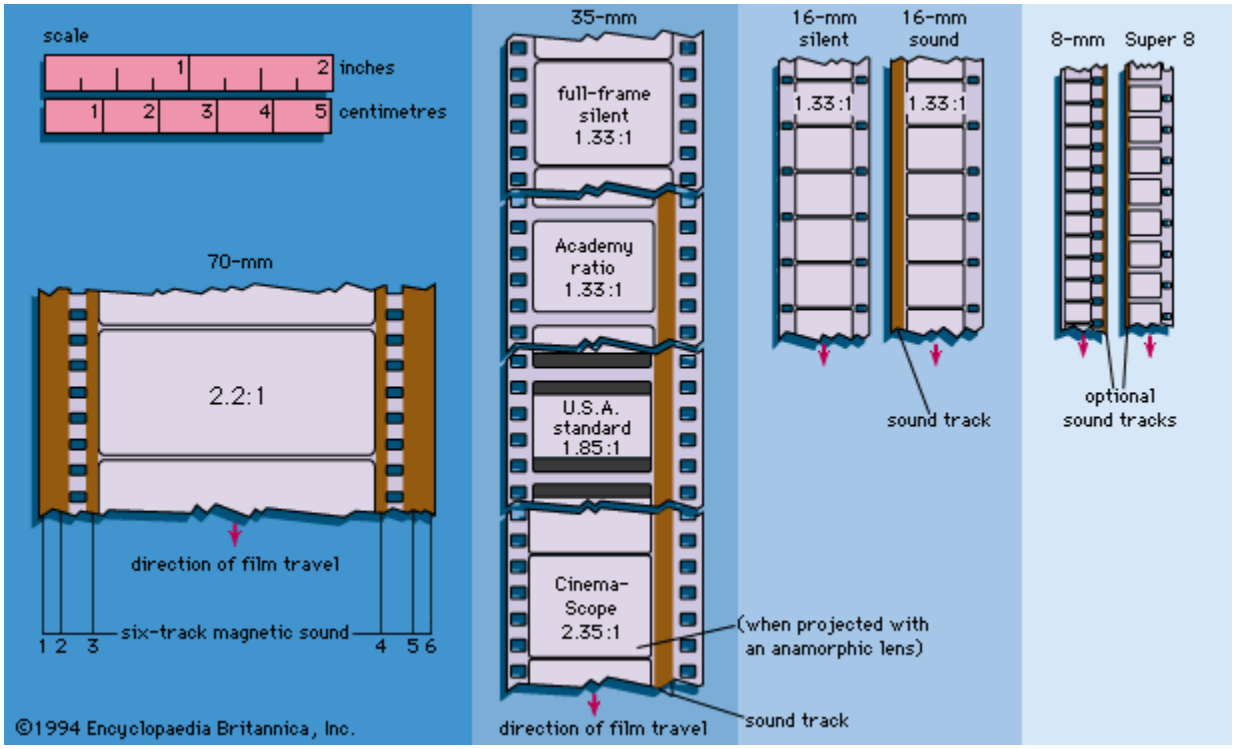
Tayloreel Corporation
www.tayloreel.com
770-503-1612
8mm and 16mm reels and cans

TekMedia Supply Company
800-323-7520
16mm cans and supplies
(no web site, sales through RTI @ www.rti-us.com)

Tuscan
www.tuscancorp.com
8mm & 16mm reels, 16mm cans

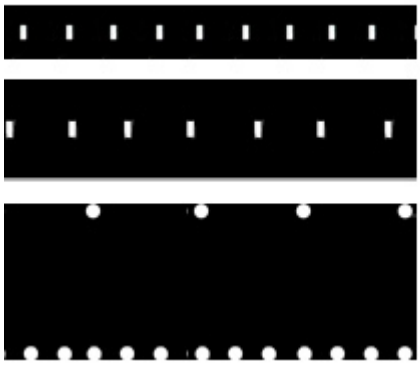
Urbanski Film
www.urbanskifilm.com
Films and film supplies

Film Formats:



Common Formats

Uncommon Formats



Black and white film:

Description
A film where all scenes no matter what the original color are represented in shades of grey.

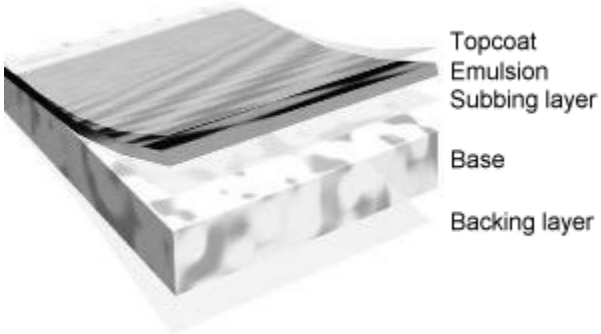
Explanation
Black and White (B&W) motion picture film generally consists of a minimum of five layers:

- a) a thin clear gelatin layer without any additions which serves as a protective layer against mechanical damage;
- b) the light sensitive layer consisting of a suspension of silver salts in gelatin (the actual emulsion). It may have been coated on one or multiple layers;
- c) the adhesive substratum which binds the emulsion to the base;
- d) the base or support consisting chiefly of nitro-cellulose (nitrate film) or acetyl-cellulose (triacetate, safety film) or polyester;
- e) there may be a further layer for anti-halation purposes; or a coating of gelatin to prevent curling; or a layer which serves both of these purposes.

Film Construction

- Topcoat/Handling Layers
- Emulsion
- Subbing Layer
- Base
- Backing Layer

Generally a conservator considers a photographic object as three components, carrier (the base), binder (the emulsion) and the image material (silver or dye).



Layers of a film

Topcoat/Handling Layers

Topcoat

This is a layer of gelatin that covers the surface of the emulsion. The layer is a slightly tougher form of gelatin and has small granular particles embeded in it that give the emulsion surface a slightly matt finish.

This aids during winding to form an evenly wound reel and has some slight optical benefits.

The binder component, a gelatin layer that contains the image forming materials. In a color film the emulsion can consist of many image forming layers, with black and white films it is uncommon to have more than two distinct layers. Image above shows a cross section of color negative emulsion before and after processing.

The emulsion layer is very thin and readily susceptible to physical damage such as abrasion or scratching. Gelatin is also quite hydroscopic and will readily absorb moisture from the air.

Gelatin is also sensitive to changes in pH. If the film has started to decompose, or has been affected by mould it may become very water soluble and aqueous treatments cannot be used.

Subbing Layer

A thin layer that allows the emulsion to better adhere to the base. The exact composition of the layer is proprietry information, but in general subbing layers are a mixture of cellulose acetate, cellulose nitrate and gelatin. The c. nitrate in the subbing layer has been linked by some researchers to accelerated decomposition but this is still an area of contention.

When a film shrinks to a significant degree it is the adhesion between the subbing layer and the emulsion or the subbing layer and the base that fails.

During film repair the subbing layer needs to be completely removed when using film cement. If this is not done the subbing layer will interfere with the strength of the adhesion of the cement repair.

Emulsion removed to reveal the subbing layer

Base

The carrier layer, with the important characteristics of transparency, toughness and flexibility. The most common film base polymer is cellulose triacetate with most collections holding lesser amounts of cellulose diacetate, cellulose nitrate and some polyester base.

Any treatment given to a film must not compromise the important characteristics. The polymers used in bases can retain considerable quantities of water even after drying. Cellulose acetates can potentially hold up to 6% water by weight, although polyester is much lower at 2%. With aqueous treatments the impact of this quantity of residual free water as a source available for decomposition reactions and mould needs to be considered.

Backing Layer

A performance enhancing layer that is applied to the underside of the base. Usually a gelatin layer, although sometimes other polymers such as poly vinyl acetate (PVA) may be used. This layer is designed to counteract any curl that is caused by a change in dimension of the emulsion due to temperature and humidity by responding in a similar way to the changes in environment.

During conservation treatments the gelatin in this layer will behave in a similar fashion to the emulsion.

Color Film:

Description

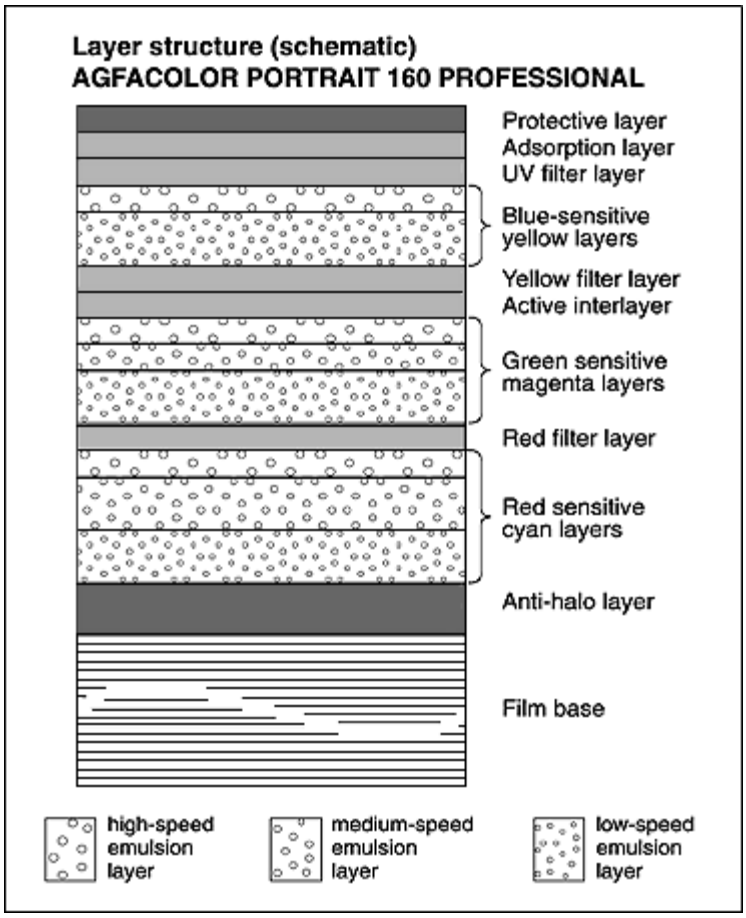
A film that carries one or more emulsions which after processing carries a record of the colors in the original scene. This may be a negative (opposite) or a positive record.

Explanation

Color film has an even more complex structure than black & white film. It can consist of many layers.

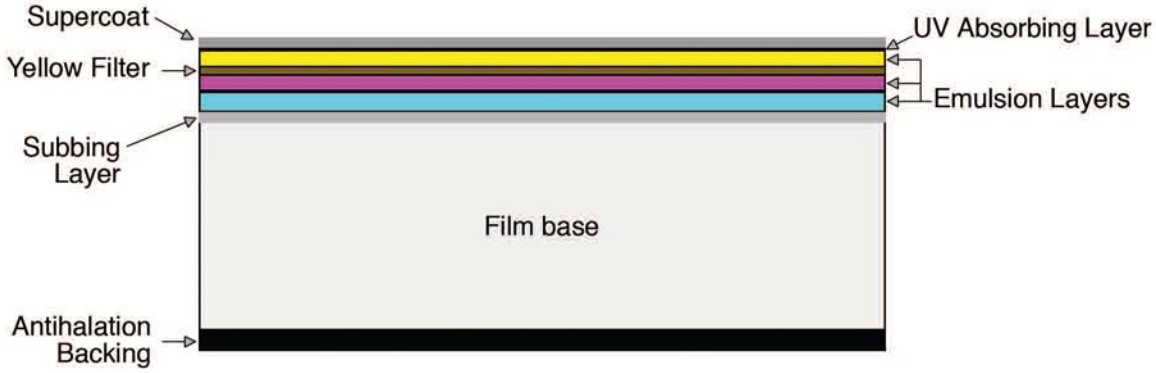
It consists of as many as nine layers with different functions:

a. a protective layer of clear gelatin;
b. a blue-sensitive recording layer consisting of gelatin in which silver salts and a color coupler are embedded;
c. a yellow filter layer which absorbs the blue rays of light not absorbed in the blue-sensitive layer but lets through the green and red rays;
d. a green-sensitive layer;
e. an interlayer of prepared gelatin which prevent dyes produced, especially during development, from migrating from their own layer and hence spoiling the image;
f. a red-sensitive layer;
g. an adhesion substratum;
h. the base or support is usually made of cellulose triacetate or polyester;
i. an anti-halation layer which may also serve as an anti-curl layer.



Unprocessed Processed

Color negative film emulsion cross section



Bibliography:

Adelstein, Peter Z., Jean-Louis Bigourdan and others. IPI Media Storage Quick Reference. (Rochester, NY: Image Permanence Institute, 2004).

American National Standard for Imaging Materials-Reflection Prints-Storage Practices. ANSI/NAPM IT9.20-1996. (New York: American National Standards Institute, 1996).

Association of Moving Image Archivists (AMIA), The Home Film Preservation Guide (www.filmforever.org).

The Book of Film Care. Kodak Publication No. H-23. (Rochester, NY: Eastman Kodak Company, 1983).

Reilly, James M. IPI Storage Guide for Acetate Film. (Rochester, NY: Image Permanence Institute, 1993).

Reilly, James M. Storage Guide for Color Photographic Materials. (Albany, New York: The University of the State of New York, New York State Education Department, New York State Library, The New York State Program for the Conservation and Preservation of Library Research Materials, 1998).

Wilhelm, Henry, and Carol Brower. The Permanence and Care of Color Photographs: Traditional and Digital Color Prints, Color Negatives, Slides, and Motion Pictures. (Grinnell, Iowa: Preservation Publishing Company, 1993).

So, you've got some films in your collection.

What do you do now? The following is a brief walk-through of three preservation plans to consider when housing an academic film archive.

Things to consider if you do decide to keep the films:

1. Films are complicated. Sometimes not so easy to identify. The prints could be without credits, perhaps they are A-B rolls, work prints, incomplete. Don't be afraid to get your hands dirty and do a bit of investigation. Know how to read a print—and read it as best as you can.

2. Do you have a dry, cool place to keep the films in the meantime and during their full stay in your collection? Warm, damp environments accentuate the inevitability of decay (acetate decay and color fading)

3. Do you have access to any volunteers, student workers, or staff to help with preservation activities?

4. What is your preservation plan? There are three to work with:

No-cost—

Create a case file for each title. This includes history of acquisition, a physical inspection & condition report. At this point note any deterioration, report your findings and look into taking proper steps to slow down the degradation process. Create a simple, but easily accessible database. See if there are any grant opportunities that might help you finance more involved preservation activities—perhaps there are researchers interested in your collection who might help, or donors. Join the Association of Moving Image Archivists listserv (www.amianet.org). Here you will have access to other institutions and archives who love to answer questions.

Low-Cost—

1.
Continue with No-cost activities

2.
Acquire copy of NFPF's *Film Preservation Guide: The Basics for Archives, Libraries and Museuums* available as free downlowd (www.filmpreservation.org) or order a free copy from Natioinal Film Preservation Foundation: 870 Market Street, Suite 1113, San Francisco, CA, 94102.

3.
Set up a workstation. This includes an inspection worktable with rewinds, split reels, plastic take-up reels and cans and a viewer (Moviescoop) to look at your films and a footage counter that will help you measure the length and time of your film as well as help determine film shrinkage. Each format (16mm, 8mm, and Super 8) needs its own set of equipment. You will need a film cleaning system, too. We use 1500 Anti-static Film Cleaner and Conditioner with a lint-free cloth. You will need equipment with which to repair all mechanical damages made to film: tape-splicer with additional rolls of tape and tape with which to repair the sprocket hole tears. You will need to wind your films on plastic cores or reels and kept in archival plastic cans. Obtain A-D Strips to help test for acetate decay (Vinegar Syndrome) and molecular sieves should V.S. be detected. And of course, you will need plenty of labels because you must label everything.

Now you are ready to start inspecting, cleaning, repairing and re-housing your film.

The Inspection Process:

What are we looking for?

The Following questions come from NFPF's Film Preservation Guide:

How long is the film?
What is the gauge?
What is the film base? (acetate or nitrate)
Is the manufacturer name printed along edge?
Are there edge codes that might help with identification and dating? (see handout for Date Code Chart)
Is it silent or sound?
If is sound, what type of track does it have? (optical or magnetic)
Is it positive, negative or reversal film?
Does it have credits?
How much mechanical damage in terms of splices, scratches, broken sprocket holes?
How many feet from the start does the damage occur?
Degree of shrinkage as measured by a shrinking gauge, footage counter, or comparing it to fresh film stock?
Observable mold? Has the growth caused lasting damage?
Other signs of decay or damage?

Types of Damage & Decay:

Mechanical damage
Mold, mildew, fungus
Acetate Decay (vinegar syndrome)
Shrinkage
Color fading
Nitrate decay

_____

Mechanical Damage—

Due to mishandling of the film (tears, scratches)
Dirty work table (scratches)
Dirty projector (scratches)
Threaded incorrectly in the projector (tears, broken sprockets)
If the film has shrunk troubles with the projector are sure to happen

Fixed repairing tears and break with tape splicer or sprocket tape. Note: Tears, damaged splices and broken sprockets can be repaired but scratches are permanent

Mold, Mildew and Fungus—

If stored under humid conditions
Organisms attack from outside edge and make their way into roll
Can cause significant damage to emulsion

Stopped by cleaning film (perchloroethyle) and relocating to dry cool environment.
Note: Once organism have eaten into emulsion the image loss is irreversible.

Vinegar Syndrome (Acetate Decay Process)—

The films smells like vinegar
Film base shrinks--curls & warps
Film loses flexibility
Emulsion may crack and fall off
White powder appears along edge and surface of film

Acetic vapor released from affected prints and will infect other acetate based materials near by. Store V.S. prints away from rest of collection and do not share cans or reels of V.S. prints with those not affected. Note: Process can be delayed but degradation can not be stopped.

Shrinkage—

Symptom of acetate decay, but also affects nitrate base films (overly dry conditions)
Particular problem with small gauge films
Once film has shrunk beyond %.8 may be damaged in projector

Tools to test for film's shrinkage:
Shrinkage gauge
Footage counter
Compare against new stock of same gauge

Color Fading—

All brands and types of color film WILL fade over time
Three dye layers lose color at different rates
Heat and high humidity accelerate process
Process can be slowed but not reversed

Nitrate Decay (5-step Process)

1. Image fading. Brownish discoloration of emulsion. Faint noxious odor
2. Sticky emulsion, cont'd faint noxious odor
3. Emulsion softens and blisters with gas bubbles. Odor more pungent
4. Film congeals into solid mass. Strong noxious odor
5. Film disintegrates into brownish powder

Deteriorated nitrate film is hazardous waste and should be removed to authorized facility for disposal.

Ideal Preservation Plan:

Reformatting for access--creating copies on video or digital formats to be used by researchers. Help avoid further wear on original film.

Reformatting for preservation--creating new film master, viewing print and access copies. This is important if the original film is deteriorating. [See Washington State Pres. Manual pp. 26-28]

How do we care for film?

Basic terms:
[Courtesy of NFPF's Film Preservation Guide]

Conservation—
Is the protection of the original film artifact…Many organizations guard the original from unnecessary handling by creating surrogate copies to carry the content. These copies are used for exhibition and research. The film original can then be stored under conditions that slow physical decay.

Duplication—
Is the making of the surrogate copy. Preservationists consider film fully safeguarded only when it is both viewable in a form that faithfully replicates its visual and aural content and protected for the future by preservation masters from which subsequent viewing copies can be created.

Restoration—
Goes beyond the physical copying of the surviving original materials and attempts to reconstruct a specific version of the film. Ideally this involves comparing all known surviving source materials, piecing together footage from these disparate sources into the order suggested by production records and exhibition history, and in some cases, enhancing image and sound to compensate for past damage.

Access—
Is the process through which film content is shared with the public. Depending on the institution, access embraces a range of activities, from support of on-site research to exhibition of the Internet. In museums, libraries and archives, the most common access media at this time is film and video.

Sample Condition Report:

Collection/Title: Kurtich Collection/ "Minotaur-Final Footage for 1973 production"

Length: 561 ft; 15.58 min. (*image to image*); 598 ft.; 16.61 min. (*end to end*)

Black & White ___ **Color** __x_
Silent _x__ **Sound** ___
Gauge: 16mm
Material: _x__ Triacetate ___ Diacetate ___ Polyester
Generation: ___ Positive __x_ Reversal
___ Fine Grain ___ Soundtrack Only __x_ Image Only
Language/Head Titles/Intertitles/Subtitles:

Physical Damage:
Marked on a scale of 1 (slight) to 4 (heavy)

_____ Emulsion Scratches ___0__ Projector Oil & Dirt

__0___ Base Scratches ___0__ Warpage

__0___ Perforation Damage ___0__ Shrinkage

__0___Edge/Perforation Repair ___0__ Color Fading

Number of Splices: 1

Vinegar Syndrome (Acetate Decomposition Level)* __0___
*Marked on a scale of 0 (no deterioration) to 3 (critical)

Notes: From Purple Box# 38. On can reads the following: "Minotaur print of final footage for 3 projectors but not used in the presentation—still in original form from the lab. 1973 production." Card accompanying reel which reads: "REEl 1: Tiryns Back Passage; Steps at Mycenae (removed); Knossos (removed). REEL 2: Tiryns Rock Gallery (removed); Mycenae Secret Passage (removed); Mallia. REEL 3: Great Goddess (Janice); Troize Walk; Mycenae Lion Gate; Treasury of Athens; Heraelion Market; Streets of Myconos". Cleaned with ECCO 1500 Film Cleaner and conditioner.

Completed by: _____T.H._____ Date: ____6/16/2008_____