



# The Restoration of Early Sound Recordings Using Optical Metrology and Image Analysis

Lawrence Berkeley National Laboratory and The Library of Congress



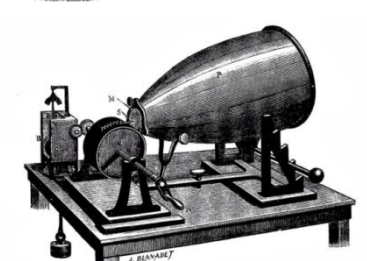
Historical recorded sound collections are at risk and are difficult to access.

Use optical surface profiling to create digital maps of the record surface, retouch image to repair damage, play with a virtual needle.

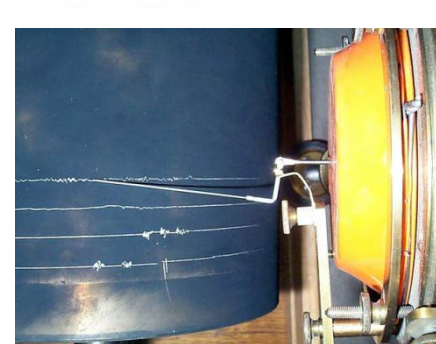
## What is sound recording?



Phonautograph  
Leon Scott  
1853-60



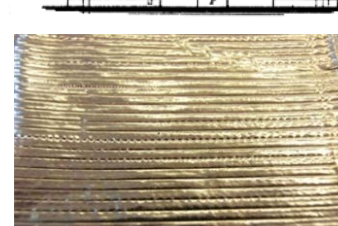
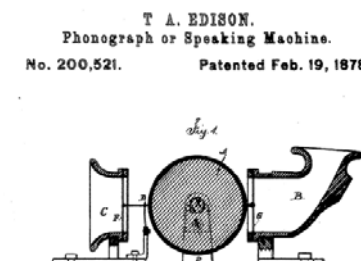
Scott **enscribed** sound on paper and **could not reproduce it**



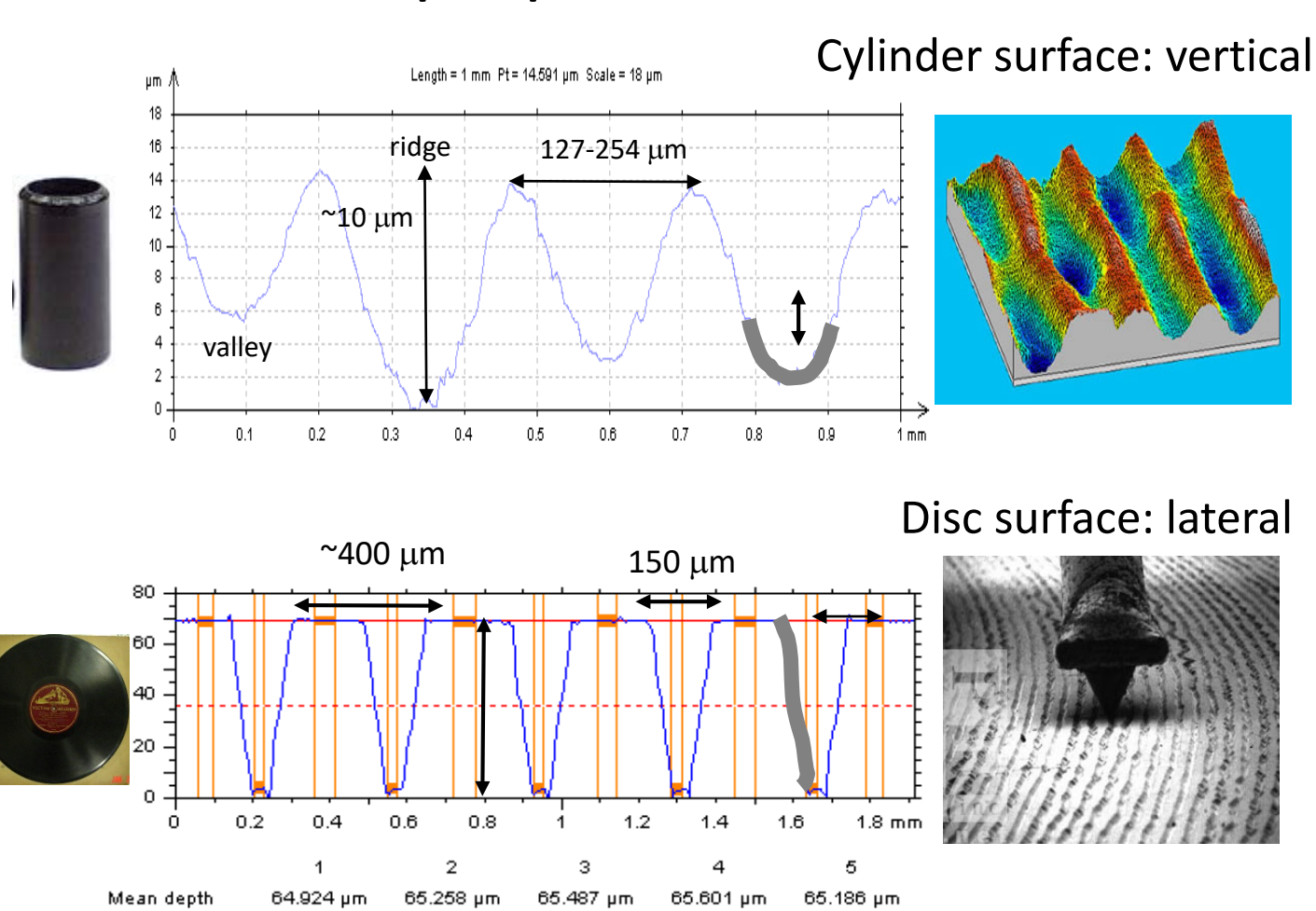
Edison **embossed** sound on foil and was first to reproduce it.



Phonograph  
Thomas Edison  
1877



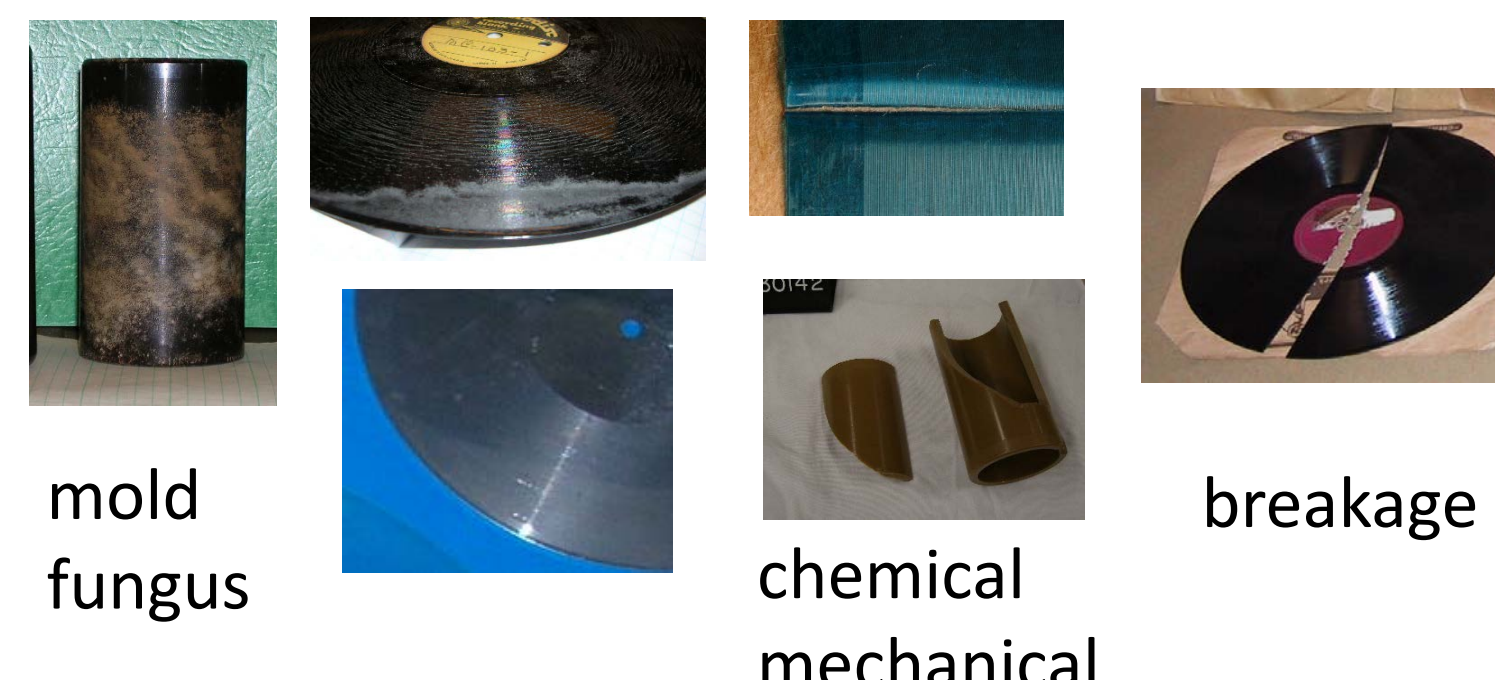
## Mechanical properties of common records



## Inventors \* Fieldwork \* History \* Studio

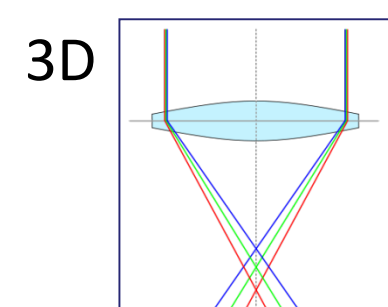
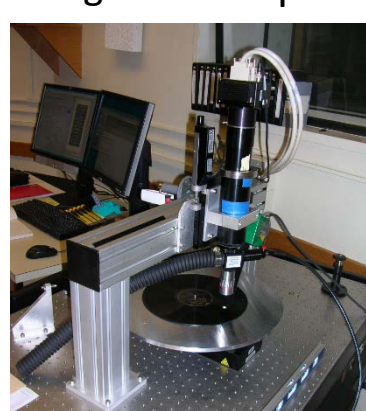


Sound recordings are at risk

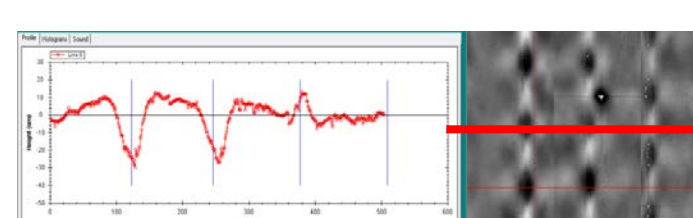
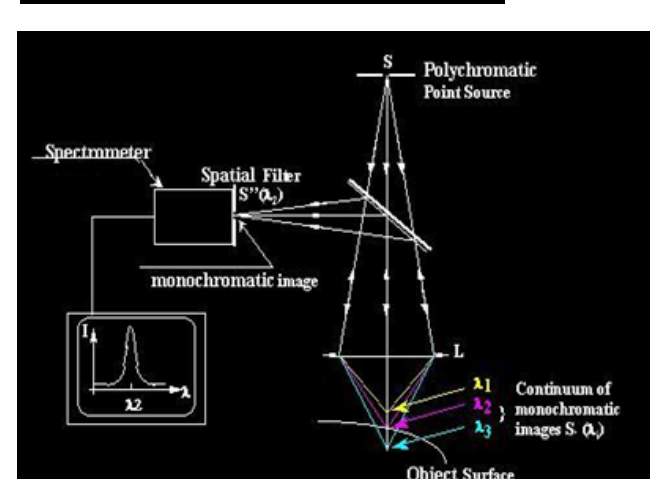
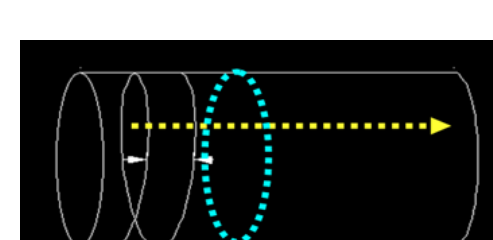


## Imaging Methods

Hi-res digital microphotography

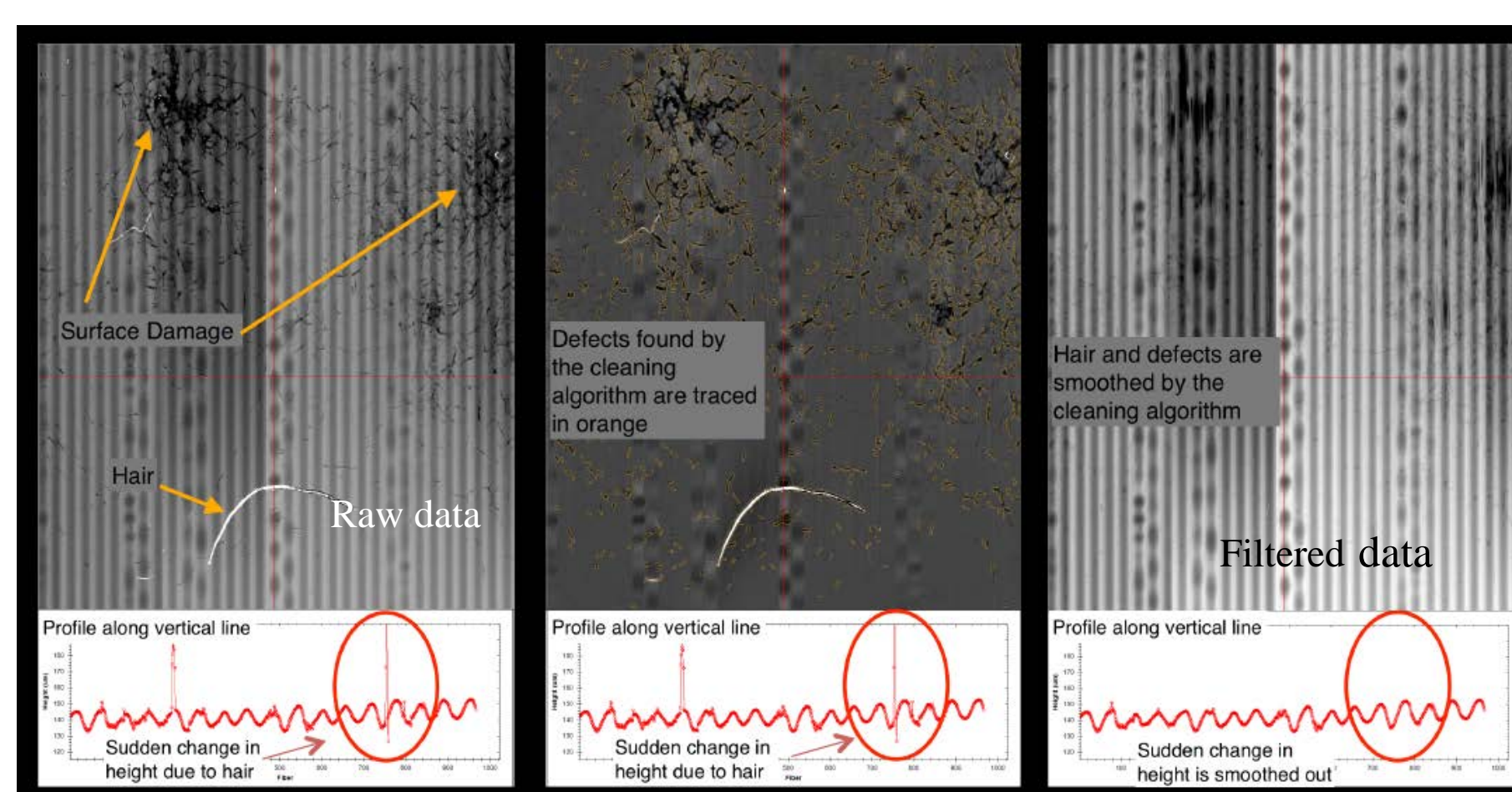


3D: confocal microscopy



## Optical Scans: An inclusive data set

3D depth image: darker = deeper

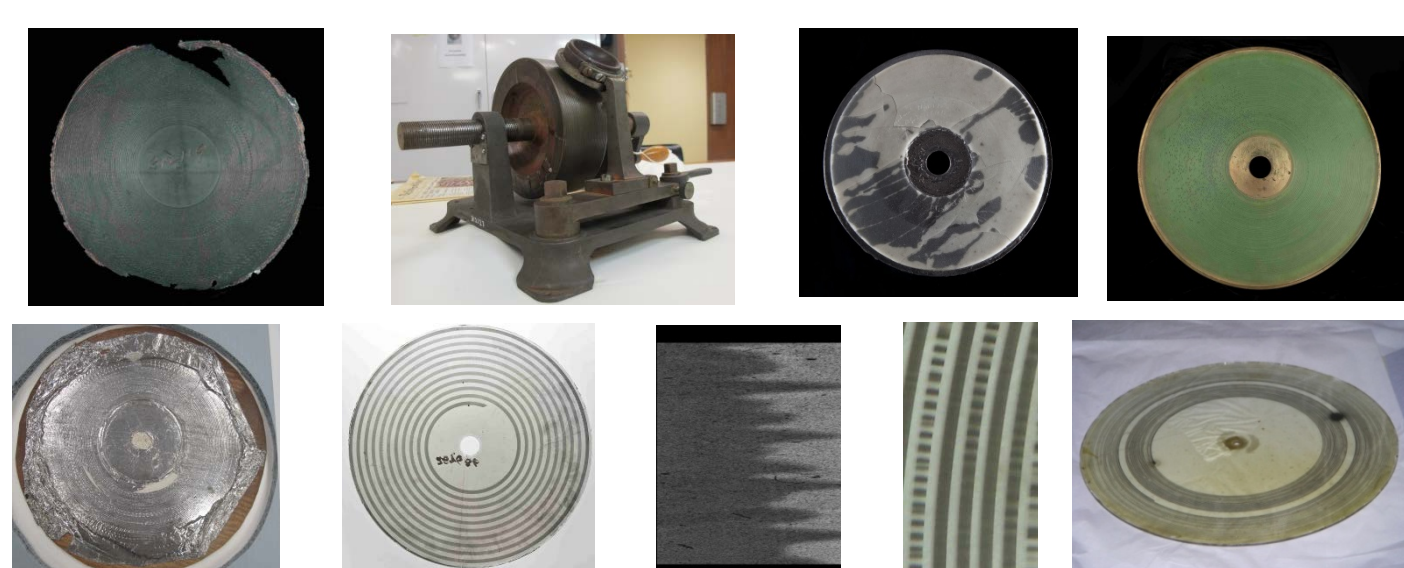


Processed to emphasize structures and locate defects

Examples of important collections which are being studied using optical scanning methods.

## Alexander Graham Bell Recordings

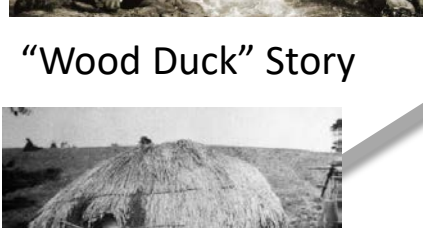
In 1880 Bell establishes Volta Laboratory in Washington, D.C., to conduct signals research in association with chemist Chichester Bell and instrument builder Charles S. Tainter. Experimented with an astounding variety of materials and formats. Artifacts and notes are in the Smithsonian Institution (>200 recordings). 12 Key recordings are optically scanned and exhibited in 2015: "Hear My Voice: Alexander Graham Bell and the Origins of Recorded Sound" <http://americanhistory.si.edu/exhibitions/hear-my-voice>



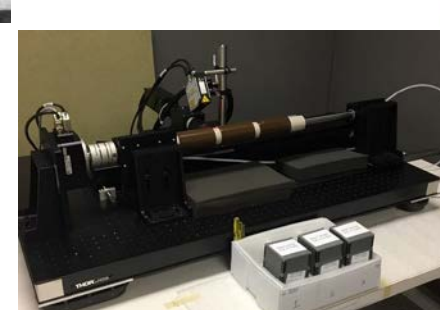
## Univ. of California Language Survey

77 Native American languages are represented in the collection of ~3000 wax cylinders >2700 have been optically scanned and restored to date

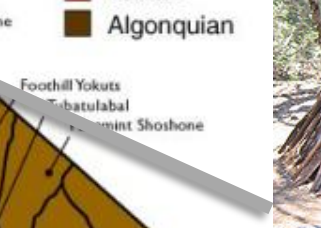
Yahi - Ishi 300 Recordings



Pomo 31 Recordings



California Indians Root Languages



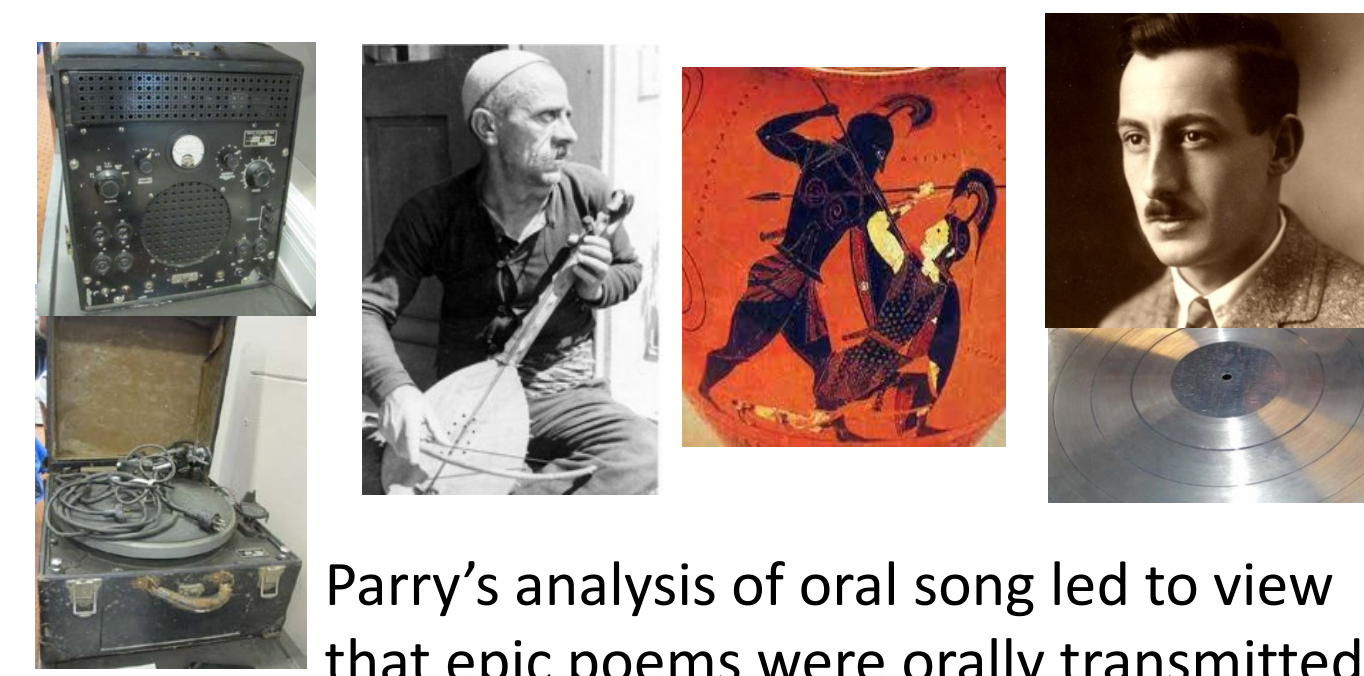
Central Sierra Miwok 145 Recordings



## Oral Literature

~1930 aluminum an improved material for field recording

Shallow irregular embossed grooves, difficult to play  
Harvard's Milman Parry Collection: 6000 recordings  
Developing a robust and efficient optical process



Parry's analysis of oral song led to view that epic poems were orally transmitted.

Activities are supported by the:



Haute école d'ingénierie et d'architecture Fribourg  
Hochschule für Technik und Architektur Freiburg

