

Introducing a New Standard for Optical Archival Data Storage

**1st International Workshop on
Standards and Technologies in
Multimedia Archives and Records (STAR)**

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CSO**

Millenniata

- **Worlds First Permanent Optical Archival Solution**
- **Data etched into durable, inorganic “stone”**
- **Backward Compatible – Readable in quality DVD drives**



Permanent ?

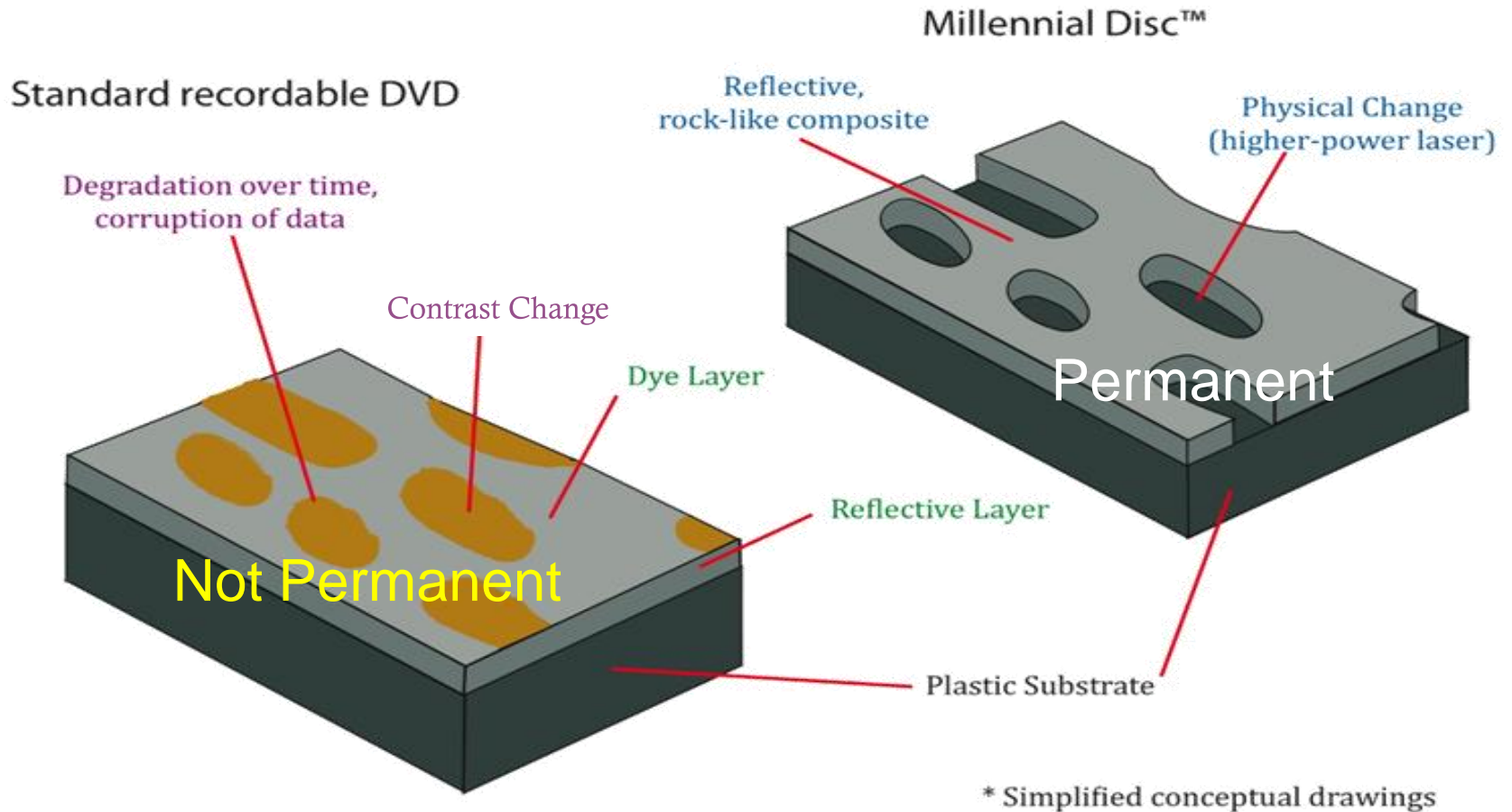
Life expectancy at a 95% confidence level
(random failure of at least 5%):

- **HARD DRIVES:** *3 to 10 years¹*
- **SOLID STATE (flash):** *10 to 12 years¹*
- **CD-R/DVD-R , RW:** *6 months to 10 years^{1,2}*
- **MAGNETIC TAPE:** *< 30 years^{1,2}*

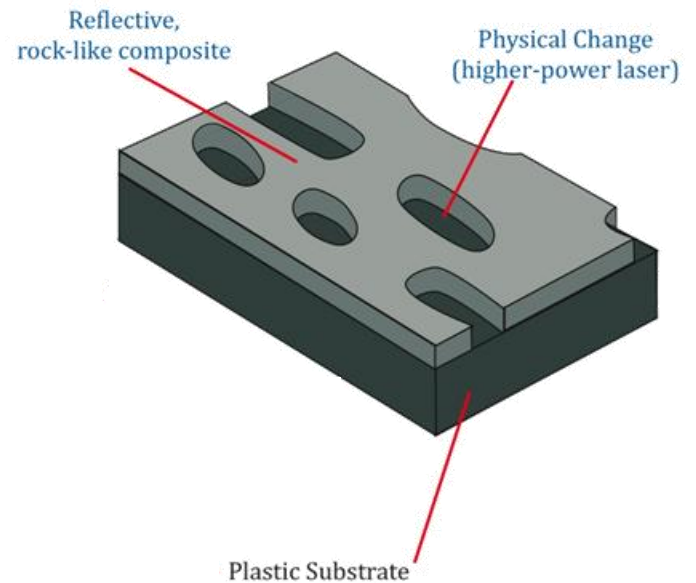
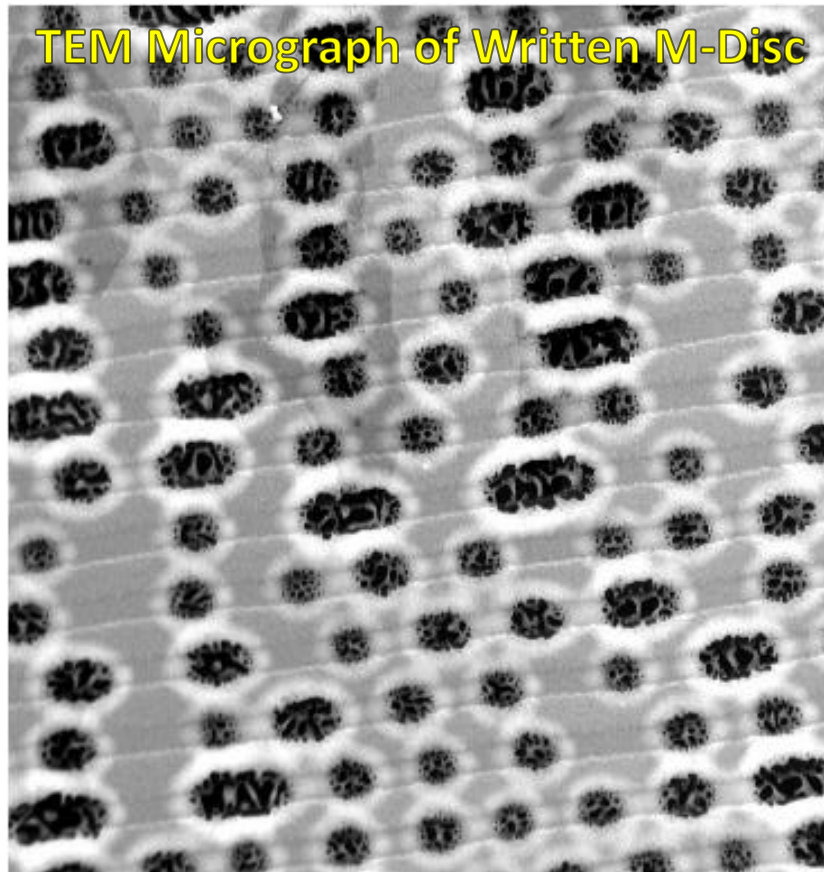
¹Energy-intensive and/or

²special environmental storage conditions required

Disc Comparison

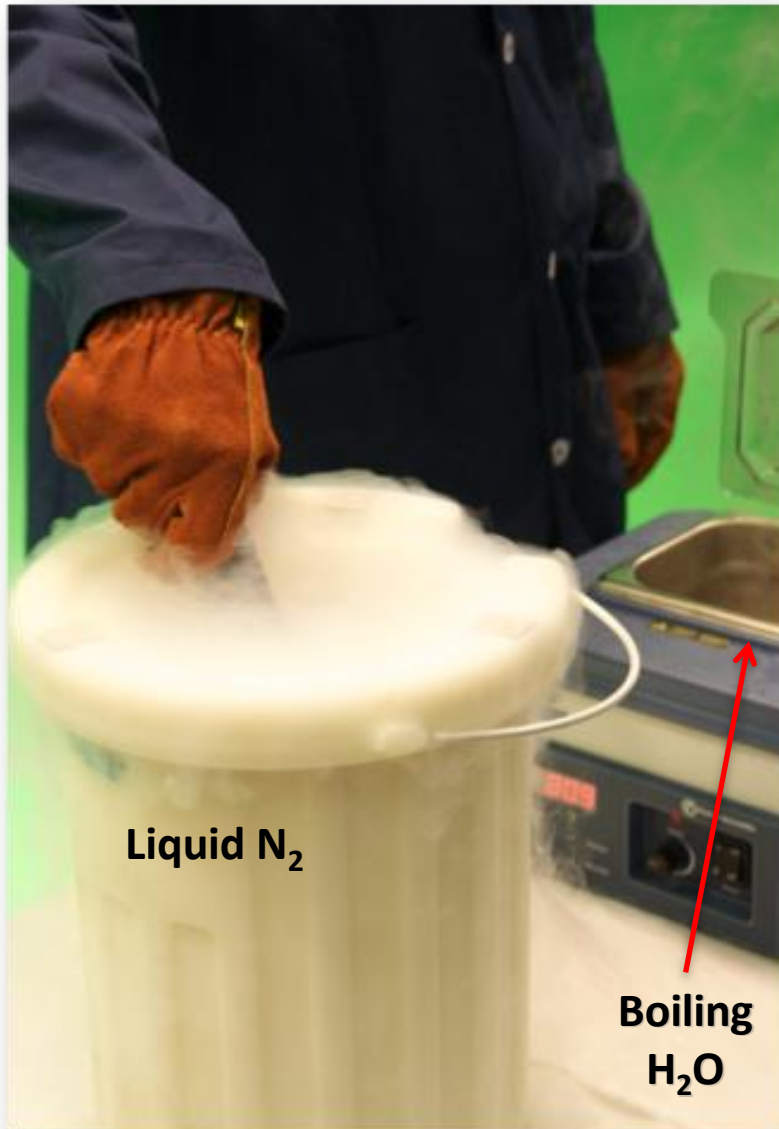


It really is a “hole”



**The Millenniata M-Disc stores data as
a durable, physical mark**

Durability: Extreme Conditions



M-Disc™

M-Disc is unaffected and still readable after repeated dipping in boiling water and liquid nitrogen



Conventional DVD

Life Cycle Testing

Facility:

Naval Air Warfare Center Weapons Division

Conditions:

- Temperature: 85°C (per ECMA 379)
- Relative Humidity: 85%
- Natural Light: MIL Std. 810G
- Time Period: 25.5 hours

Results:

“None of the Millenniata media suffered any data degradation at all. Every other brand tested showed large increases in data errors after the stress period.”

(for full report see Accelerated Life Cycle Comparison of Millenniata Archival DVD, November 10, 2009)

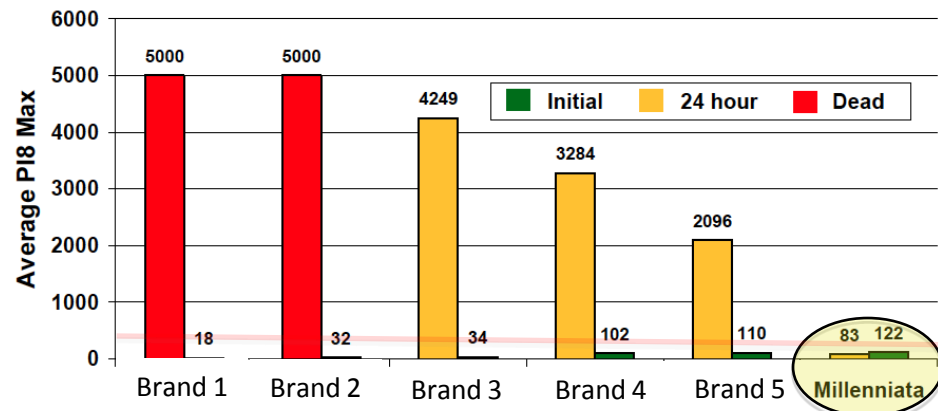


Figure 3-23 P18 Max Average by Manufacturer Including Dead Discs

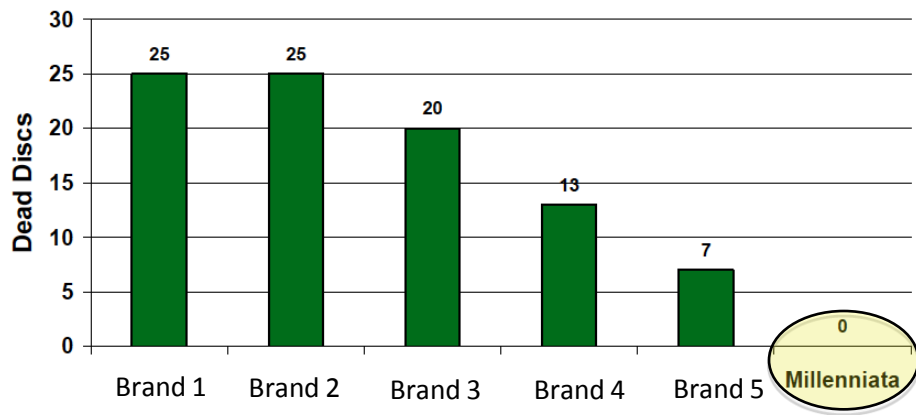
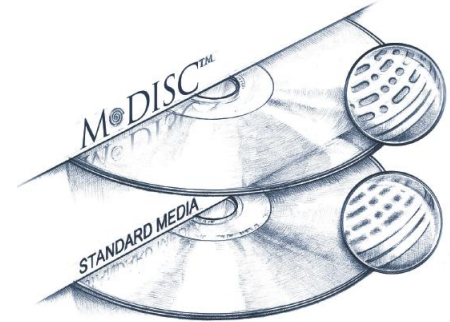


Figure 3-24. Number of Discs Dead After Stress Cycle

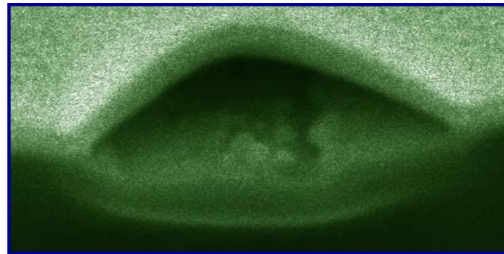
M-Disc Technology

- **Robust physical holes are better than the alternatives**
 - The process IS NOT reversible
- **Creating holes – moving material – requires more energy**
- **Altering inorganic, stable materials requires more energy**



M-Disc Technology

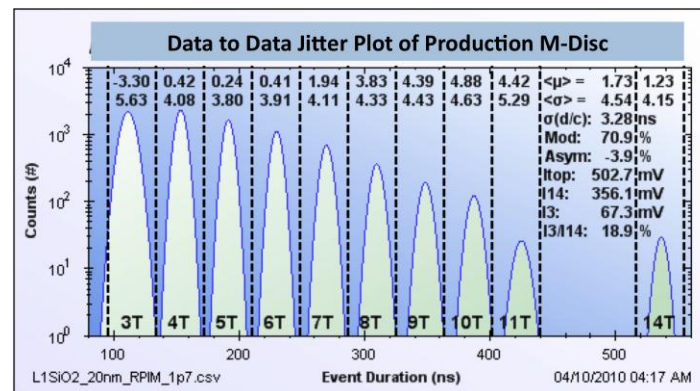
- **More energy means:**
 - Increase absorption to keep the power requirement reasonable
 - Lower Reflectivity : 23% to 27%



- Different physical mechanisms and kinetics
- Response to laser irradiation is different from existing DVD definitions
- Write Strategy restrictions in existing ECMA standards are not optimal

M-Disc Technology

- **Write Strategy status:**
 - **4X -R Multipulse (1/32 T) with 50 – 60 mW power**
 - **4X – 8X -R Castle (Modified) with up to 80 mW power**
 - **-R Castle (Modified) gives better write quality, but is not available in existing drives**



A New Archival Format

- **+M – A low-reflectivity write-once format for permanent data storage**
- **Physical recording mechanism**
 - holes – not marks
- **Inorganic materials**

A New Archival Format

- **Key physical characteristics:**
 - **Reflectivity: 23% to 27%**
 - **Wobble Groove: Standard ADIP**
 - **Jitter: < 9.0%**
 - **Modulation: $\geq 60\%$**
- **Write Strategy (minimum):**
 - **4X -R Multipulse (1/32 T) 50 – 60 mW power**
- **Write Strategy (preferred):**
 - **4X – 8X -R Castle (Modified) up to 80 mW power**

The Millenniata Solution

A permanent archival storage medium

- Digital data etched into “stone”
- Validated Longevity
- A new data archive paradigm
- No special storage requirements
- Disruptive data-storage technology

