The DP Method A Novel Semi-Quantitative Method for Surveying Heritage Collections

Kathryn Royce, D.Phil. Candidate, University of Oxford









First things first

Slides available to download

- http://mineralcare.web.ox.ac.uk
- Conferences => NatSCA 2023
- > What we're covering today
 - Intro to the DP State Survey Method
 - How to Survey
 - ➢ How to Analyse Basic
 - How to Analyse Intermediate

How to Excel version

- How to use Excel* to facilitate the surveying process
- ➤ Tips mentioned:
 - 1. Sorting
 - 2. Freeze Panes
 - 3. Colour & Lines
 - 4. Conditional Formatting
 - 5. Autosum & Autofill
 - 6. Pivot Tables



Position within the Collection Assessment

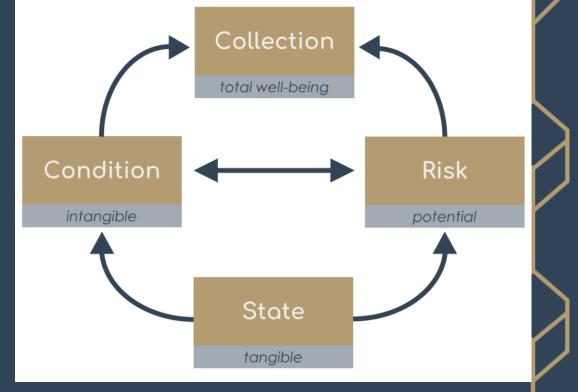
3 parts necessary to assess overall collection well-being

- 1. State: object properties, environment, housing materials
- 2. Condition: values, uses, intactness, appearance, etc.
- 3. Risk: likely exposure & outcomes to agents of change

The DP Method

Focuses on state rather than condition

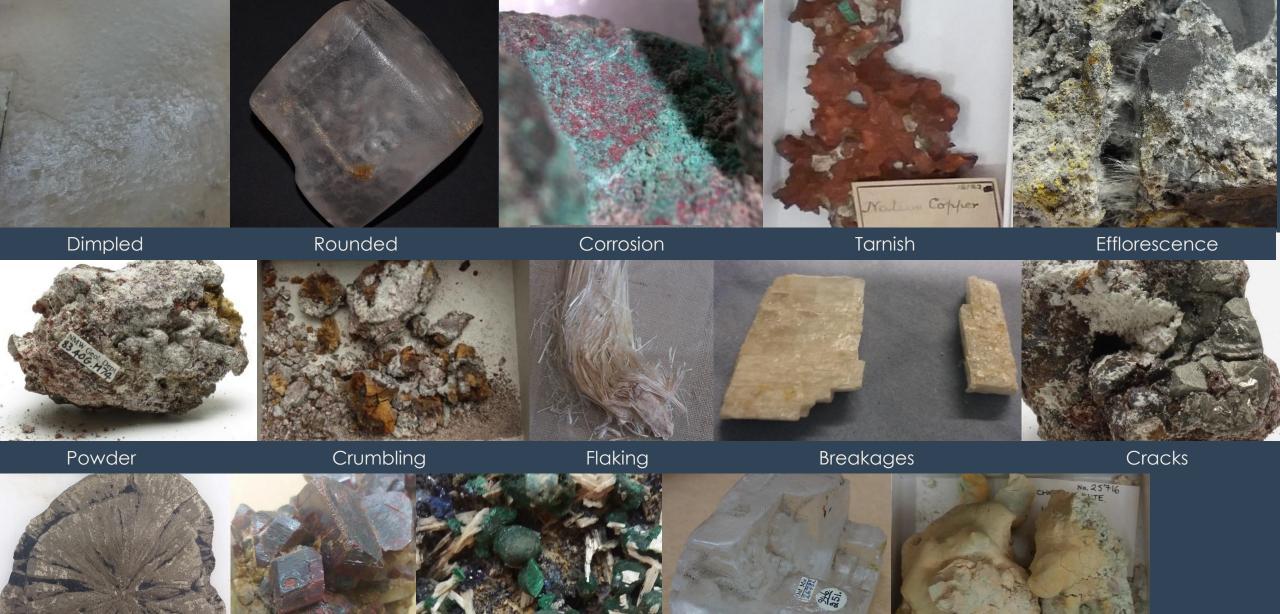
- > Enables more quantitative measurements
- Addresses many problems w/ current condition assessment surveys
 - > subjectivity, ambiguity, variability



Deterioration Phenomena (DP)

Dimple	 Rounded 	Corrosion	Tarnish	▲ fflorescence	Powder	 Crumbling 	Flaking	 Breakages 	Cracks	0 1 0 1	Darker	Lighter	Opacity	 plour Change
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- Visually indicative of change to given collection
 - > Not all DP applicable to every object
 - Some DP more indicative of deterioration than others
- Limited & pre-defined
- Presence/absence only (1 / 0)
 - No determination of extent/severity
 - Increase speed, reduce variability, avoid assigning quantitative values to subjective perception
- Cause of change attributed during data analysis
 - Minimise distraction, interpretational bias,
 & attribution error



Dull

Dark

Pale

Opacity

Colour Change

5

Dark Coloured mineral is a darker shade of that colour or black





Pale

Coloured mineral is a lighter shade of that colour or white/colourless

Opacity Mineral has become 'clouded', translucent, or opaque

Pre-Survey

- Identify the collection(s) to survey
- Select DP that reflect how those 2. collection items deteriorate
 - Must be visual change
 - Doesn't have to be quantifiable
- 3. Define the DP
 - Verbally
 - Pictorially
- 4. Collect pre-existing object information from CMS
 - Accession/object number
 - Species name/material type
- 5. Set up your survey spreadsheet



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× AutoSave 🔵 Off) 📙 🛛 🌳 🖓 🗸 £↓ ∡↓ ≂ ♀ Search OUNHM-State_Survey-all.xlsx 🗸 File Home Page Layout Formulas Data Review View Automate Developer Help Power Pivot Insert \checkmark : $\times \checkmark f_x$ Boracite G107 Н D G Ζ А Κ Μ N Ρ R S Ο O Change **Other Notes** Imbling Breakages Corrosior Dimpled arnish Flaking Slumpec Opacity Powder Cracks Acc. # Dull Dark Pits Main Min. Hey # Strunz # ď Assoc. Min. Colour (MIN.) **↓**↑ ---5/J.03-10 31044 22 o 147 9.3.14 1 Colemanite 0 148 9.3.22 5/J.03-20 21814 22 o 1 Hydroboracite 0 149 9.3.22 5/J.03-20 22741 22 o 1 Hydroboracite 0 150 9.3.22 5/103-20 30364 22 0 1 Hydroboracite 0 1 realgar: yellow (pararealgar) on upper surface

> 0 0 0

0

0

0

0

Organics

0

0

Other things

0

0

0

0

0

(+)

0 0

0 0

Curatorial & Conservation

Notes to help make future you's life easier

E&A S&S 2x O&OH Carb. Halides Sulfates T,C,&M I&B P,A,&V Silica Silicates

> Missing labels

- > Needs repair/treatment
- > Missing specimens/parts
- Temporary removal
- > Asbestiform/radioactive

X Accessibility: Investigate EO Ready

151 9.3

156

157

158

159 160

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162

163

164 165

166 167

168

169

Count: 46



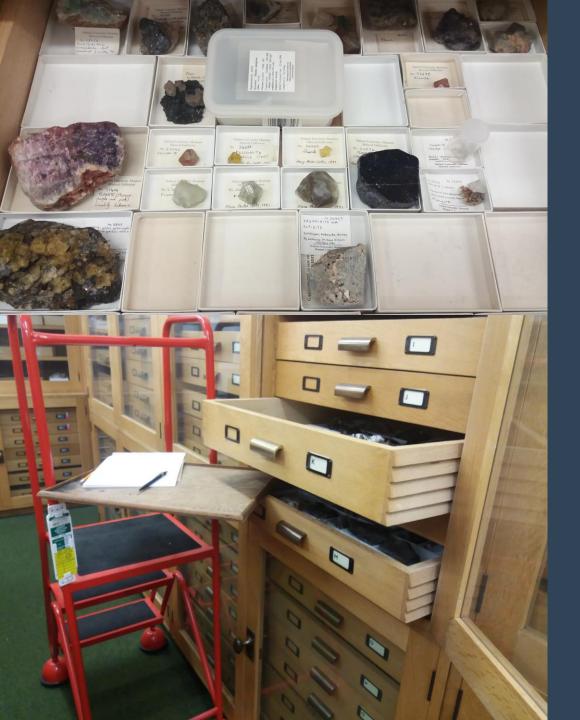
Surveying

fairly straightforward

- 1. examine object for DP
- 2. type in corresponding 0s & 1s
- 3. enter any additional information (e.g., location, habit)



	А	В	С	D	E	F	G	Н	T	J	K	L	м	Ν	0	Ρ	Q	R	S	Т	U	V	w	x
1	Cabinet	Drawer/Shelf #	# of pt.	Main Min.	Assoc. Min.	Form/Habit	Location	Dewy	Slumped	Corrosion	Tarnish	Efflorescence	Powder	Crumbling	Delamination	Flaking	Pits	Breakages	Cracks	Dull/Matte	Darker	Lighter	Opacity	Colour Change
2	6	f	1	pyrite		pyritohedral, aggregate	unknown	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0
2																								



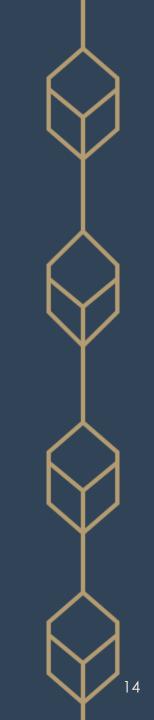
Surveying

fairly straightforward

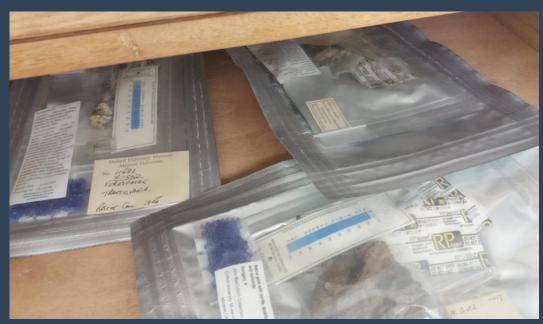
- 1. examine object for DP
- 2. type in corresponding 0s & 1s
- 3. enter any additional information (e.g., location, habit)

SAVE FREQUENTLY

- Treat first few days as pilot
 - confirm DP applicable & sufficiently defined
 - identify skipping methods
 - > adjust setup or approach







Skipping Specimens

OK to skip

- minerals in microenvironments (bagged, boxed)
- 2. bagged asbestiform
- 3. well-represented species (e.g., quartz, calcite, fluorite)
- If a species > 50 specimens,
- ➢ min. = 50; max. = 200
- \succ usually ~25% of total specimens
 - > use parametric statistical methods
 - statistically representative sample size

Identifying Deterioration

- Presence of multiple DP suggests deterioration has occurred
- > Out of scope of survey to determine if active or not
 - Cannot be determined by visual observations alone
- Certain combinations suggest potential reaction types:
 - \succ surficial oxidation
 - > oxidation at depth
 - pollutant-induced oxidation
 - ➢ efflorescence
 - ➤ surface wetting
 - physical forces





How to Analyse - Basic

Simple Exploratory

- Frequencies & Averages
- Addresses the 'what'
- Performed in Excel
 - > only w/ survey data
 - \succ facilitated by Pivot tables
- Visual pattern recognition & mapping to reaction type
 - > 1^{st} order = affects > 50%
 - \succ 2nd order = affects < 50%





1	J	K	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	X	Y	Z
Dimpled	Slumped	Corrosion	Tarnish	florescence	Powder	Crumbling	Flaking	Pits	Breakages	Cracks	Dull	Dark	Pale	Opacity	Iour Change	Total	Colour Change
-	-	-	-	-	-	-	-	-	-	-	-	-	•	-		-	Ŭ Ţ
0	0	0 0	0	1 0	1	0	0	0	0	0	0	0	1	1	0	4	
0	0		0 0 0	0	0	0	0 0	0 0 0	0	0 1	0	1	0	1 0	- 0	2	
0	0 0 0 0	0	0	0	1	1	0	0	0	0	0	0	0	0	- 0	2 0	
0	0	0	0	0	0	0	0	0	0	0 1	0	0	0	0	- 0	0	
0	0	0	0 0	0	1	1	0	0		1	0	0	0	0	- 0	3 1	
0	0	0	0	0	0	0	1 0	0	0		0	0	0	0	- 0	1	
0	0 0 0	0	0	0	0	0	0	0 0 0	0	0 1 1	0	0	0	0	0	1	
1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	
0	0 0	0	0	1	0	0	0	0 0	0	0	0	0	1	0 0 0 1	- 0	1 2 3 1	
0	0	0	0 0	0	1	0	0		0	0	0	0	0		- 0	1	
0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	3	
0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
																2	ADP

Total DP

- Sum of all present DP
- > Total of all the 1's in each row
- Calculated w/ AutoSum

Average DP (ADP)

- Average of all total DP
- Represents average number of DP seen per object
- Calculated w/ AutoAverage

Percent DP (%DP) & their Patterns

C.

% average of DP
observed / species, et
Used to determine
1 st & 2 nd order cause
of deterioration

Conditional Fo	ormatting Key
75–100%	Red
50–74%	Orange
25–49%	Yellow
0–24%	N/A

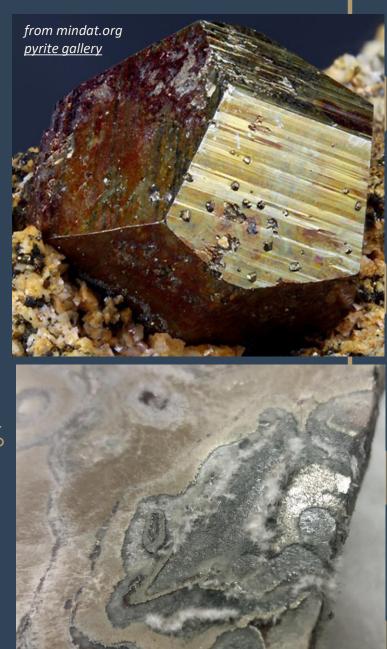
	Averag	ge													Type of deterioration	
MINERAL	% Dim	% Tarı	% Effle	% Pow	% Crui	% Flak 9	% Pits	% Brea	% Crac	% Dull	% Dar	% Pale	% Opa	% Colo	1st Order	2nd Order
Vonsenite	0%	0%	0%	0%	0%	0%	0%	0%	100%	25%	0%	0%	0%	0%	Physical forces	Surfical Oxidation
Fluoborite	0%	0%	67%	0%	0%	0%	0%	0%	67%	0%	0%	0%	0%	0%	Efflorescence	_
Berborite	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	—	_
Wightmanite	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	—	—
Canavesite	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	100%	Surfical Oxidation	—
Sulfoborite	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	_	—
Szaibelyite	0%	0%	50%	0%	0%	0%	0%	0%	50%	0%	0%	50%	0%	0%	Efflorescence	—
Sussexite	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	—	—
Pinnoite	0%	0%	0%	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	Physical forces	_
Kurnakovite	0%	0%	100%	100%	0%	0%	0%	0%	50%	0%	0%	100%	100%	0%	Efflorescence	—
Inderite	0%	0%	100%	100%	0%	0%	0%	0%	100%	0%	0%	100%	100%	0%	Efflorescence	_
Inderborite	0%	0%	0%	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%	33%	Physical forces	_
Meyerhofferite	0%	0%	0%	100%	75%	0%	0%	50%	25%	0%	0%	0%	0%	0%	Physical forces	_
Inyoite	0%	0%	0%	100%	0%	0%	0%	100%	0%	0%	100%	0%	0%	0%	Physical forces	_
Tincalconite	0%	0%	0%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	Physical forces	_
Borax	0%	0%	0%	100%	33%	17%	0%	0%	17%	0%	0%	0%	0%	67%		
Boracite	29%	0%	5%	0%	0%	0%	0%	3%	8%	0%	34%	0%	0%	0%	—	surface wetting
Ulexite	0%	0%	7%	64%	36%	7%	0%	0%	21%	0%	64%	7%	0%	14%		
Colemanite	29%	0%	18%	12%	6%	6%	0%	12%	35%	0%	12%	0%	0%	0%	—	surface wetting
Hydroboracite	0%	0%	20%	0%	20%	20%	20%	0%	100%	0%	40%	0%	0%	20%	Physical forces	_
Kernite	0%	0%	75%	100%	0%	25%	0%	0%	50%	0%	0%	75%	75%	0%	Dehydration	_
Probertite	0%	0%	0%	50%	50%	0%	0%	0%	50%	0%	25%	0%	0%	0%	Physical forces	—
Hilgardite	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	Physical forces	_
Tunellite	25%	0%	25%	25%	0%	0%	0%	0%	50%	0%	0%	25%	25%	0%	Physical forces	surface wetting
Preobrazhenskite	0%	0%	100%	0%	0%	0%	0%	0%	100%	0%	100%	0%	0%	0%	Efflorescence	
Braitschite-(Ce)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	_	—
Hambergite	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	_	—
Total	13%	1%	16%	29%	11%	4%	1%	4%	34%	1%	22%	10%	7%	7%	<u> </u>	Physical forces

%DP Patterns Example: Pyrite

DP	%DP	# of spec.			
Corrosion	11%	143			
Tarnish	86%	1,095			
Efflorescence	23%	295			
Powder	7%	85			
Crumbling	21%	271			
Flaking	5%	60			
Breakages	9%	117			
Cracks	56%	715			
Dull	78%	990			
Dark	57%	729			
Colour Change	33%	422			
Total # of specimens	1,274				

2nd Order: Oxidation at Depth Signs of Pyrite Decay < 25%</p>

- Efflorescence
- > Powder
- > Crumbling
- ➢ Breakages



How to Analyse - Intermediate

Extended Exploratory

- Contextualise survey data w/ associated information
- Can supplement w/ data from analytical methods
- Begins to address the 'why'
- Performed in Excel w/ pivot tables
 - > ADPs & %DP patterns
- Examine data subsets
 - Location in store
 - Locality/Geography
 - > Habit/Form
 - Different storage conditions







$\left \begin{array}{c} \\ \\ \end{array} \right $	
\checkmark	>

	А	В	С	D	E F	G	Н	I	J	К	L	M	PivotTable Fields	~	×
1	Strunz #	Acc. # (MIN.)	Cabinet		Main Min.	Total							Choose fields to add to report:	Drag fields between are below:	
-	4/L.02-10	19543			1 Salesite	0			Cabinata						
	4/L.02-20	19530			1 Bellingerite	1		Average of Total	Cabinets				Strunz #		
	5/	22305			1 Rhodizite	0		Row Labels	- 22) Grand Total			Acc. # (MIN.)		
	5/G.03-10	21203			2 Warwickite	2			2	2			Cabinet		
	, 5/G.03-20				1 Pinakiolite	0		⊞n	2	2			Drawer/Shelf #		
	5/G.04-10	16995	22 1	n	1 Ludwigite	1	S	∃o	2	2			☐ # of pt.	Columns	
8	5/G.04-10	26882	22 I	n	1 Ludwigite	1	wers	⊟p	1	1			Main Min.	Cabinet	~
	5/G.04-10		22 I	n	1 Ludwigite	1	≥	Boracite	1	1			✓ Total		
10	5/G.04-10	28832	22 I	n	1 Ludwigite	2	La	Canavesite	3	3					
11	5/G.04-10	26526	22 I	n	1 Gaudefroyite	0		Preobrazhenskit	e 3	3			More Tables		_
12	5/G.04-20	21850	22 I	n	1 Vonsenite	1		Rhodizite	0	0				Rows	
13	5/G.04-20	26348	22 I	n	1 Vonsenite	1		Tunellite	2	2				Drawer/Shelf #	~
14	5/G.04-20	26349	22 I	n	1 Vonsenite	1		Grand Total	2	2					·
15	5/G.04-20	27590	22 I	n	1 Vonsenite	2								Main Min.	~
16	5/G.05-10	21827	22 I	n	1 Fluoborite	1									
17	5/G.05-10	26869	22 I	n	1 Fluoborite	1									
	5/G.05-10	27510			1 Fluoborite	2								Σ Values	
	5/G.06-10	26422			1 Berborite	0		Use ADP to	o find hots	note				Average of Total	~
	5/G.06-20	21848			1 Wightmanite	0				-					
	5/G.06-40	27575			1 Canavesite	3		> Source	of leak/pe	ests					
	5/G.11-10	1297	22 I		9 Sulfoborite	0	(/				
	5/H.02-10	21843			1 Szaibelyite	2									
24	5/H.02-10	26412 &B Tota			1 Szaibelvite	1		E 4				• •		Defer Layo Up	pdate

Use as Category or Filter in Pivot Tables

AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	Pyrite
Locality	# of spec.	Corrosion	Tarnish	Efflorescence	Powder	Crumbling	Flaking	Breakages	Cracks	Dull	Dark	Pale	ColourChange	Locality (Count # of spe Corrosi
Algeria	4	25%	100%	0%	0%	0%	0%	0%	0%	50%	50%	0%	50%	Tarnish
Aotearoa (New Zealan	2	0%	100%	50%	0%	0%	0%	0%	50%	100%	50%	0%	0%	Efflores
Australia	2	0%	100%	50%	0%	50%	0%	0%	50%	100%	50%	0%	0%	Powder
Austria	5	20%	100%	0%	0%	40%	0%	0%	80%	80%	20%	20%	40%	Crumb
Bolivia	3	33%	100%	33%	0%	67%	0%	0%	100%	100%	100%	0%	67%	Flaking
Brazil	8	50%	88%	0%	0%	0%	0%	13%	50%	75%	50%	0%	63%	Breaka
Canada	9	22%	89%	0%	11%	22%	0%	11%	44%	89%	44%	0%	44%	
Chile	3	0%	67%	0%	0%	0%	0%	0%	33%	33%	33%	0%	0%	Cracks
Colombia	4	0%	100%	25%	0%	25%	0%	0%	75%	100%	25%	25%	0%	Dull
Cyprus	6	0%	100%	33%	0%	17%	0%	0%	50%	100%	33%	17%	0%	Dark
Democratic Republic c	1	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	Pale
Denmark	1	0%	0%	100%	0%	0%	100%	0%	100%	100%	0%	100%	0%	Colour
England	265	22%	89%	22%	3%	23%	4%	13%	56%	88%	67%	2%	35%	
Finland	1	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	
France	12	0%	75%	17%	0%	0%	0%	0%	17%	42%	33%	0%	25%	
Germany	7	29%	100%	43%	0%	29%	0%	0%	57%	100%	43%	14%	14%	
Greenland	1	0%	100%	0%	0%	0%	0%	0%	100%	100%	0%	0%	0%	\sim
Hungary	2	0%	50%	0%	0%	0%	0%	0%	0%	50%	50%	0%	0%	
Iceland	1	0%	100%	0%	0%	0%	0%	0%	0%	100%	100%	0%	0%	
Iran	1	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	
Ireland	6	0%	100%	17%	0%	17%	0%	17%	100%	100%	83%	0%	33%	
Italy	112	6%	95%	29%	16%	38%	13%	21%	70%	67%	49%	1%	44%	
Japan	3	33%	67%	0%	0%	33%	33%	33%	33%	67%	33%	0%	67%	
Kosovo	1	0%	100%	0%	0%	0%	0%	0%	0%	100%	100%	0%	0%	
Mexico	7	14%	57%	0%	0%	29%	0%	0%	57%	71%	43%	0%	14%	
North Africa	1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	

Pyrite							
Locality							
(Country)	England	Italy	Peru	Spain	USA	Wales	
# of spec.	265	112	25	28	52	219	
Corrosion	22%	6%	0%	7%	8%	1%	
Tarnish	89%	95%	60%	54%	83%	86%	
Effloresce	22%	29%	8%	18%	6%	26%	
Powder	3%	16%	0%	0%	4%	3%	
Crumbling	23%	38%	4%	29%	10%	23%	
Flaking	4%	13%	0%	0%	0%	3%	\boldsymbol{V}
Breakages	13%	21%	0%	4%	6%	4%	
Cracks	56%	70%	40%	57%	31%	<mark>66</mark> %	
Dull	88%	67%	32%	54%	65%	73%	
Dark	67%	49%	12%	21%	35%	57%	
Pale	2%	1%	4%	18%	2%	7%	
ColourCha	35%	44%	16%	18%	27%	26%	

Identify:

- main contributors
- areas for further exploration & analysis

23

	Locality	# of spec.	1 st Order	2 nd Order
-	Cornwall 96 Surficial C		Surficial Oxidation	Physical Forces
and	Cumbria	33	Surficial Oxidation	Physical Forces
England	Devon	29	Surficial Oxidation	Oxidation At Depth
	Kent	13	Surficial Oxidation	Oxidation At Depth
≥	Piedmont	49	Surficial Oxidation	Oxidation At Depth
Italy	Tuscany	57	Surficial Oxidation	Physical Forces
Peru	La Libertad Department 8 Surficial Oxidation			
ain	Andalusia	7	Physical Forces	
Spain	La Rioja	11		Physical Forces
	Colorado	18	Surficial Oxidation	Physical Forces
NSA	New York	7	Surficial Oxidation	
	Pennsylvania	12	Surficial Oxidation	Physical Forces
	Carmarthenshire	26	Surficial Oxidation	Oxidation At Depth
	Ceredigion	15	Surficial Oxidation	Physical Forces
Sé	Denbighshire	13	Surficial Oxidation	Oxidation At Depth
Wale	Gwynedd	102	Surficial Oxidation	Physical Forces
>	Powys	12	Physical Forces	Surficial Oxidation
	Vale of Glamorgan 18		Surficial Oxidation	Physical Forces

How far to push your subsets?

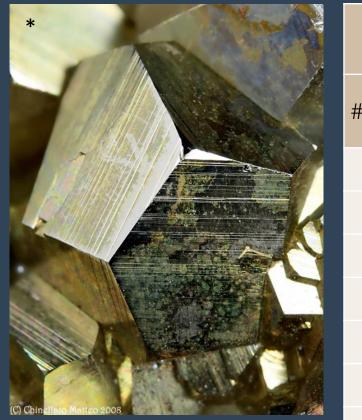
As far* as they can go

Can find interesting info
 & trends

- Reveal previously unknown relationships
- Provide further areas for research

* To maintain statistical rigor * (& to be able to use parametric methods) datasets should consist of **at least 30 objects**

24





*Photos from mindat.org - pyrite gallery

	Rio	Elba	All
of spec.	16	55	1,274
Corr.	0%	7%	11%
Tarnish	100%	95%	86%
Efflor.	31%	24%	23%
Powder	6%	5%	7%
Crumb.	38%	33%	21%
Flaking	0%	16%	5%
Break.	6%	16%	9%
Cracks	63%	69%	56%
Dull	38%	53%	78%
Dark	6%	24%	57%
Colour Change	50%	33%	33%
ADP	3	4	4

Rio La Marina Elba, Tuscany, Italy







Preview: Advanced Statistical Analysis

Formal Analysis

- Performed in SPSS
- Bivariate correlation:
 Pearson's correlation coefficient (r)
- Factor analysis: Principal Component Analysis
 - Observe multi-dimension association
 - Dimensionality reduction: see which variables to remove/combine
- Reliability analysis:
 Cronbach's Alpha (ρ_T)

Results are comparable to 'Basic' Analysis

Differences:

- More in-depth findings
- Produces numerical values (e.g., test statistics)

Get in touch if you would like a walk-through of the SPSS analysis

kathryn.royce@ouce.ox.ac.uk



the DP Method: a summary

SEMI-QUANTITATIVE & STATISTICALLY RIGOROUS

- > Solid foundation for collection assessments
- Can track changes over time
- Used to infer reaction pathways
- Supplement w/ contextual info
- **CUSTOMISABLE** to collection/material type
- FAST data collection: ~ 1 minute/specimen*
- > **COMPATIBLE** w/ any spreadsheet programme

Walk-through videos & documents coming soon! http://mineralcare.web.ox.ac.uk

Thank you for listening!

This work is an output of a collaborative doctoral research project, supported by collaborators from the following institutions:

- University of Oxford, School of Geography & the Environment Prof. Heather Viles \geq
- National Museum Cardiff Dr. Jana Horak, Tom Cotterell >
- National Museums Liverpool Dr. Christian Baars
- BSRIA Ltd. Tom Gagarin >
- OR3D James Earl

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- The Barbara Whatmore Trust
- The Pilgrim Trust
- The National Conservation Service



Questions?

kathryn.royce@ouce.ox.ac.uk

http://mineralcare.web.ox.ac.uk

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Kathryn Royce ॷ 🖉

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Comments 🖻 Share 👻

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A B C D E F G H I J K L M N O P Q R S T U V
Hey# Strunz# Acc.# Wain Min. Assoc. Min. Main Min. Assoc. Min. Main Min. Normation of the second of the secon
147 9.3.14 5/1.03-10 31044 22 0 1 Colemanite 0 <
149 9.3.22 5/1.03-20 22 v 1 Hydroboracite 0 0 0 0 0 1 0
150 9.3.22 5/1.03-20 30364 22 0 1 Hydroboracite 0
151 9.3.22 5/1.03-20 30368 22 o 1 Hydroboracite 0 0 0 0 0 1 0
152 9.3.22 5/J.03-20 30369 22 0 1 Hydroboracite 0
153 9.1.6 5/1.04-10 21856 22 0 1 Kernite 0
154 9.1.6 5/J.04-10 22 404 22 0 10 Kernite 10 0
155 9.1.6 5/J.04-10 27886 22 0 1 Kernite 0 0 0 1 0
156 9.1.6 5/J.04-10 30356 22 0 1 Kernite 0
157 9.1.6 5/J.04-10 30357 22 0 0 Kernite Image: Constraint of the constraint
158 9.1.14 5/J.05-10 21204 0 0 Larderellite Image: constraint of the second
159 9.3.20 5/J.05-30 22902 22 n 1 Probertite realgar 0 0 0 0 0 1 0 1 0 1 0
160 9.3.20 5/J.05-30 22903 22 n 1 Probertite realgar 0 0 0 1 1 0
161 9.3.20 5/J.05-30 22904 22 n 1 Probertite realgar 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
162 9.3.20 5/J.05-30 30367 22 n 1 Probertite 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0
163 10.1.8-10 5/K.04-10 28853 Hilgardite boracite
164 10.1.8-10 5/K.04-10 28861 22 o 4 Hilgardite boracite 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
165 9.3.31 5/K.06-20 30374 22 p 1 Tunellite 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
166 9.3.31 5/K.06-20 30375 22 p 1 Tunellite 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
167 9.3.31 5/K.06-20 30376 22 p 1 Tunellite 0 0 0 0 1
168 9.3.31 5/K.06-20 30377 22 p 1 Tunellite 0
169 9.2.05 5/K.08-10 30264 22 p 1 Preobrazhenskite 0 0 0 0 1
E&A S&S 2x O&OH Carb. Halides Sulfates T,C,&M I&B P,A,&V Silica Silicates Organics Other things 🕂 : •
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Hey #	# Strunz #	Cabinet # ">>> awer/Shelf #		Assoc. Min.	Slumped	Corrosion Tarnish	e	Powder Crumbling	Flaking Pits	Breakages Cracks			Upacity lour Change	 Total Colour Change 		cher Notes				
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116 9.3.14	5/J.03-10	31044 22 o	1 Colemanite		0 0	-	0 0	0 0	0 0		-	0 0	0 0	0						
117 <mark>9.3.22</mark>	5/J.03-20	21814 <mark>22</mark> o	1 Hydroboracite		0 0	0 (0 0	0 0	0 0		0	1 0	0 0	2						
118 9.3.22	5/J.03-20	22741 <mark>22</mark> o	1 Hydroboracite		0 0	0 (0 0	0 0	1 0	0 1	0	1 0	0 0	3						
119 <mark>9.3.22</mark>	5/J.03-20	30364 22 o	1 Hydroboracite		0 0	0 (0 0	0 1	0 0	0 1	0	0 0	0 1	3 realga	r: yellow	(parare	algar) or	upper su	rface	
120 <mark>9.3.22</mark>	5/J.03-20	30368 22 o	1 Hydroboracite		0 0	0 (0 1	0 0	0 0	0 1	0	0 0	0 0	2						
121 <mark>9.3.22</mark>	5/J.03-20	30369 22 o	1 Hydroboracite		0 0	0 (0 0	0 0	0 1	0 1	0	0 0	0 0	2						
122 9.1.6	5/J.04-10	21856 <mark>22</mark> o	1 Kernite		0 0	0 (0 1	1 0	0 0	0 1	0	0 1	1 0	5						
123 <mark>9.1.6</mark>	5/J.04-10	22404 <mark>22</mark> o	10+ Kernite		0 0	0 (0 1	1 0	0 0	0 1	0	0 1	1 0	5						
124 9.1.6	5/J.04-10	27886 <mark>22</mark> o	1 Kernite		0 0	0 (0 0	1 0	1 0	0 0	0	0 0	0 0	2						
125 <mark>9.1.6</mark>	5/J.04-10	30356 <mark>22</mark> o	1 Kernite		0 0	0 (0 1	1 0	0 0	0 0	0	0 1	1 0	4						
126 9.3.20	5/J.05-30	22902 22 n	1 Probertite rea	algar	0 0	0 (0 0	0 0	0 0	0 1	0	1 0	0 0	2						
127 9.3.20	5/J.05-30	22903 <mark>22</mark> n	1 Probertite rea	algar	0 0	0 (0 0	1 1	0 0	0 0	0	0 0	0 0	2						
128 9.3.20	5/J.05-30	22904 22 n	1 Probertite rea	algar	0 0	0 (0 0	0 0	0 0	0 0	0	0 0	0 0	0						
129 <mark>9.3.20</mark>	5/J.05-30	30367 22 n	1 Probertite		0 0	0 (0 0	1 1	0 0	0 1	0	0 0	0 0	3						
130 10.1.8-:	10 5/K.04-10	28861 22 o	4 Hilgardite bo	racite	0 0	0 (0 0	0 0	1 0	0 0	0	0 0	0 0	1						
131 9.3.	.31 5/K.06-20	30374 22 p	1 Tunellite															-		
132 9.3.	.31 5/K.06-20	30375 22 p	1 Tunellite		C	opy	y yc	our	date	a int	0 0	ser	Dard	ate d	ata f	ile f	or a	naly	sis!	
133 9 3	21 5/K.06 20	30376 22 p	1 Tunellite	C	0 0		/ /: 1	0 0	0 0	0 0			I U	3						•
	I&B Total		(+)							E (Þ
Ready 💽	Contraction Accessibility:	Good to go													Ħ		J – –	-	+	100%

Example: Pyrite

DP	%DP
Corrosion	11%
Tarnish	86%
Efflorescence	23%
Powder	7%
Crumbling	21%
Flaking	5%
Breakages	9%
Cracks	56%
Dull	78%
Dark	57%
Colour Change	33%
# of Specimens	1,274

<u>xploratory</u>	
1 st Order: Surficial Ox.	
2 nd Order: Ox. at Depth	

Principal Components

- 1. Physical Forces
- 2. Tarnish only
- 3. Limonitisation
- 4. Pyrite decay

rightarrow PCs 2 & 3 = Surficial Ox. ightarrow PCs 4 = Ox. at Depth

	Pattern	Matrix ^a	4. 9	.504
		Comp	onent	
	1	2	3	4
Crumb Crumbling	0.824			
Crack Cracks	0.702			
Break Breakages	0.474			0.404
Dull Dull		0.841		
Tarn Tarnish		0.782		
Dark Dark		0.751		
Corr Corrosion			0.844	
CC Colour Change			0.767	
Flake Flaking				0.669
Powd Powder				0.643
Efflor Efflorescence				0.486

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.^a

a. Rotation converged in 17 iterations.

31

% of Variance

1. 22.560

2. 14.422

3. 12.408