

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

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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

Hello!

- ➢ How to Analyse Basic
- How to Analyse Intermediate

How to Excel version

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

* Or any other spreadsheet programme



I will appear to indicate special actions. Single clicks are indicated by red circles.

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	Dull/Matte	Darker	Lighter	Opacity	olour 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





<u>Opacity</u> Mineral has become 'clouded', translucent, or opaque

Coloured mineral is a lighter shade of that colour

Pale

or white/colourless

Pre-Survey

- 1. Identify the collection(s) to survey
- 2. Select DP that reflect how those 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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149 9.3.22	5/J.03-20	22741	22 o	1	Hydroboracite		0 (0 0	0 0	0	0	1 0	0	1	0 1	0	0	0						
150 9.3.22	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 realgar: y	ellow (pa	rarealgar) on upp	er surfa	ace	
151 9.3.22	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						
152 9.3.22	5/J.03-20	30369	22 o	-	Hydroboracite		0		0 0	0	0	0 1	0	1	0 0	0	0	0						
153 9.1.6	5/J.04-10	21856	22 o	1	Kernite		9																	
154 9.1.6	5/J.04-10	22404	22 o	10	Kernite			de	entif	i CC	itic	n												
155 9.1.6	5/J.04-10	27886	22 o	1	Kernite		1 -																	
156 9.1.6	5/J.04-10	30356	22 o	-	Kernite																			
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158 9.1.14	5/J.05-10	21204			Larderellite										JC		10							
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161 9.3.20	5/J.05-30	22904	22 n	-	Probertite	realgar			ppc.		, 5 T	IUI				_								
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167 9.3.	.31 5/K.06-20	30376	22 p	-	Tunellite		0		0		0	0 0		0	0 0	0	0	0						
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48	9.3.22	5/J.03-20	21814	22 o	1	Hydroboracite			0	0	0	0	0 0	0 0	0	0	0	1	0	1	0	0	0								
49	9.3.22	5/J.03-20	22741	22 o	1	Hydroboracite			0	0	0	0	0 0	0 0	1	0	0	1	0	1	0	0	0								
50	9.3.22	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 r	ealgar: ye	low (p	barar	realgar) on	upper sur	face		
51	9.3.22	5/J.03-20	30368	22 o	1	Hydroboracite			0	0	0	0	1 0	0 0	0	0	0	1	0	0	0	0	0								
52	9.3.22	5/J.03-20	30369	22 o	1	Hydroboracite			0	0	0	0	0 0	0 0	0	1	0	1	0	0	0	0	0								
53	9.1.6	5/J.04-10	21856	22 o	1	Kernite			0	0	0	0	1 1	0	0	0	0	1	0	0	1	1	0								
54	9.1.6	5/J.04-10	22404	22 o	10+	Kernite			0	0	0	0	1 1	0	0	0	0	1	0	0	1	1	0								
55	9.1.6	5/J.04-10	27886	22 o	1	Kernite			0	0	0	0	0 1	0	1	0	0	0	0	0	0	0	0								
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Curatorial & Conservation

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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

1 Hydroboracite

Missing labels

5/103-20

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

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150 9.3.22

151 9.3

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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)

SAVE FREQUENTLY

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



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48	9.3.22	5/J.03-20	21814 22	o 1 Hv	droboracite			0	0 0	0	0	0 0	0 0	0	0 1	0	1 (0 0	0								
49	9.3.22	5/J.03-20	22741 22	o 1 Hy	droboracite			0	0 0	0	0	0 0	0 1	0	0 1	0	1 (0 0	0								
50	9.3.22	5/J.03-20	30364 22	o 1 Hy	droboracite			0	0 0	0	0	0 1	1 0	0	0 1	0	0 (0 0	1	realgar:	yellov	w (para	arealgai) on up	per surf	ace	
51	9.3.22	5/J.03-20	30368 22	o 1 Hy	droboracite			0	0 0	0	1	0 0	0 0	0	0 1	0	0 (0 0	0								
52	9.3.22	5/J.03-20	30369 22	o 1 Hy	droboracite			0	0 0	0	0	0 (0 0	1	0 1	0	0 (0 0	0								
53	9.1.6	5/J.04-10	21856 22	o 1 Ker	rnite 🗕			0	0 0	0	1	1 (0 0	0	0 1	0	0	1 1	0								
54	9.1.6	5/J.04-10	22404 22	o 10+ Ker	rnite 🗕			0	0 0	0	1	1 (0 0	0	0 1	0	0	1 1	0								
55	9.1.6	5/J.04-10	27886 22	o 1 Ker	rnite			0	0 0	0	0	1 (0 1	0	0 0	0	0 (0 0	0								
56	9.1.6	5/J.04-10	30356 22	o 1 Ker	rnite 🗧			0	0 0	0	1	1 (0 0	0	0 0	0	0	1 1	0								
57	9.1.6	5/J.04-10	30357 22	o Ker	rnite																ten	np. rer	n. For c	rystals	naturally	/ display -	Jan.
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61	9.3.20	5/J.05-30	22904 22	n 1 Pro	obertite	realgar		0	,	/	0	U			0		,	U	U	1	0	0	1	1		_	
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67	9.3.31	5/K.06-20	30376 22	p 1 Tu	nellite			0	0 0	0	1	0 (0 0	0	00	0	0	1 1	0								
68	9.3.31	5/K.06-20	30377 22	p 1 Tu	nellite			0	0 0	0	0	1 (0 0	0	0 0	0	0 (0 0	0								
69	9.2.05	5/K.08-10	30264 22	p 1 Pre	eobrazhenskite			0	0 0	0	1	0 0	J 0	0	0 1	0	1 (0 0	0								•
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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

Presentation Tips

> How to make inputting & reviewing data easier

Tip 2: Freeze Panes

Freeze the first row(s) with column headers

ensures correct data input



Tip 3: Colour & Lines > Helps to stay on track during data entry

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1.6	5/G.04-10	26526	22 m	1	Gaudefrovite	TC ONL 10			0	0						

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Tip 4: Conditional Formatting

Colour code results



How to Analyse

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
 - \succ 1st order = affects > 50%
 - \succ 2nd order = affects < 50%



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1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	•	2	
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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



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1	A Strunz #	B Acc. # (MIN.)	Cabinet O Drawer/Shelf # O	E F Main Min.	G	H	1	J	K	 Specimens Species period 	s per spe er group	
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24	5/H.02-1	0 26412	22 m	1 Szaibelyite		Tincalconite	5/H.10-20	1				
25	5/H.02-2	0 21877	22 m	1 Sussexite		Borax	5/H.10-30	6				
26	5/H.04-1	0 30263	22 m	1 Pinnoite		Boracite	5/H.13-10	38				
27	5/H.06-1	0 21820	22 m	1 Kurnakovite		Ulexite	5/H.14-10	14				
28	5/H.06-1	0 27051	22 m	1 Kurnakovite		Colemanite	5/J.03-10	17				
29	5/H.06-1	0 30372	22 m	1 Kurnakovite		Hydroboracite	5/J.03-20	5				
30	5/H.06-1	0 30373	22 m	1 Kurnakovite		Kernite	5/J.04-10	4				
31	5/H.06-2	0 30378	22 m	1 Inderite		Probertite	5/J.05-30	4				
32	5/H.06-2	0 30379	22 m	3 Inderite		Hilgardite	5/K.04-10	1				
33	5/H.06-3	0 24133	22 m	1 Inderborite		Tunellite	5/K.06-20	4				
34	5/H.06-3	0 24134	22 m	1 Inderborite		Preobrazhenskite	5/K.08-10	1				
35	5/H.06-3	0 27602	22 m	1 Inderborite		Braitschite-(Ce)	5/K.10-10	1				
36	5/H.06-4	0 26353	22 m	5+ Meyerhofferite		Hambergite	5/L.02-10	1				
37	5/H.06-4	0 26354	22 m	5+ Meyerhofferite			Grand Total	136				
38	5/H.06-4	0 30365	22 m	10+ Meyerhofferite								
39	5/H.06-4	0 30366	22 m	1 Meyerhotterite								
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5	5/G.03-10 21		Table/Range: Total!\$A\$2:\$F\$137	-	□ Acc. # (MIN.)
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7	5/G.04-10 16			-	Drawer/Shelf #
8	5/G.04-10 26		○ <u>N</u> ew Worksheet		L # of pt.
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16	5/G.05-10 21			-	
17	5/G.05-10 26		Rhodizite 5/		
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≡ 5/G.06-10	1		
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			+ 100%

 You can make the table as detailed as you want/need

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	e													Type of deterioration	
MINERAL	% Dim	% Tarı	% Effle	% Pov	% Crui	% Flak	% 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%	_	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	1,2	274

1st Order: Surficial Oxidation
 ↓ Dull & Tarnish > 75%

- 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 $	
\sim	>

	А	В	C D	Ε	F	G		Н		J	К	L	M	DivetTable Field	de	
1	Strunz #	Acc. # (MIN.)	Cabinet Drawer/Shelf #	# of pt.	Main Min.	Total								Choose fields to add to report:	۲۲ ۲۶ ۲۶ ۲۶	Drag fields between areas below: T Filters
2	4/1 02-10	19543	22 m	1	Salesite	0										
3	4/1.02-20	19530	22 m	1	Bellingerite	1			Average of Total	Cabinets				Strunz #		
2 4	5/	22305	22 m	1	Rhodizite	0			Row Labels	22	Grand Total			Acc. # (MIN.)		
5	5/G.03-10	21203	22 p	2	Warwickite	2			⊞m	2	2			Cabinet		
6	5/G.03-20	21107	22 m	1	Pinakiolite	- 0	ſ		⊞n	2	2			Drawer/Shelf #		
7	5/G.04-10	16995	22 m	1	Ludwigite	1		S	± o	2	2			\square # of pt		
8	5/G.04-10	26882	22 m	1	Ludwigite	1		er	∃p	1	1					Cabinet 🗸
9	5/G.04-10	27309	22 m	1	Ludwigite	1		≥	Boracite	-	1					
10	5/G.04-10	28832	22 m	1	Ludwigite	2		La	Canavesite	3	3			✓ I otal		
11	5/G.04-10	26526	22 m	1	Gaudefroyite	0			Preobrazhenskite	e 3	3			More Tables		
12	5/G.04-20	21850	22 m	1	Vonsenite	1			Rhodizite	0	0					Rows
13	5/G.04-20	26348	22 m	1	Vonsenite	1			Tunellite	2	2					
14	5/G.04-20	26349	22 m	1	Vonsenite	1			Grand Total	2	2					Drawer/Sneif #
15	5/G.04-20	27590	22 m	1	Vonsenite	2										Main Min. 🗸
16	5/G.05-10	21827	22 m	1	Fluoborite	1										
17	5/G.05-10	26869	22 m	1	Fluoborite	1										
18	5/G.05-10	27510	22 m	1	Fluoborite	2										Σ Values
19	5/G.06-10	26422	22 m	1	Berborite	0		(IICO ADP to	o find hote	note					Average of Total 🗸 🗸
20	5/G.06-20	21848	22 m	1	Wightmanite	0			USE ADI I		pois					
21	5/G.06-40	27575	22 p	1	Canavesite	3		_	> Source	of leak/pe	ests					
22	5/G.11-10	1297	22 m	9	Sulfoborite	0						/				
23	5/H.02-10	21843	22 m	1	Szaibelyite	2										
24	5/H.02-10	26412	22 m	1	Szaibelvite	1			• 4							Defer Layo Update
	P		DP	LOC												

Adding Further Information

	Α	В	С	D	Ε	F	G	Н	T	J	Κ	L	М	Ν	0	Ρ	Q	R	S	Т	U	V	W	Х
1	Museu	Acc.#	habit 🔻	 npled 	 Inded 	 rrosion 	Inish	 Iorescence 	 wder 	 Impling 	 king 	 sakages 	• acks	=	rk	e	 acity 	 IourChange 	•	Mine/Quarry	Town	County (US)	County (UK)/Region/State/Pro vice	Country
2	NMC	7.37	nodule	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	4					unknown
3	NMC	80.131	cubic	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	3	Cata Mine	Guanajuato City		Guanajuato	Mexico
4	NMC	80.160	nodule	0	0	1	1	0	0	1	0	0	1	1	1	0	0	1	7		, ,		, ,	unknown
5	NMC	80.162		0	0	1	1	0	0	0	0	0	1	1	1	0	0	0	5		Folkestone		Kent	England
6	NMC	80.32	nodule	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	4		Menton	Alpes-Maritimes	Provence-Alpes-Côte d	France
7	NMC	85.104		0	0	0	1	0	0	1	0	0	1	1	1	0	0	0	5				·	Bolivia
8	NMC	85.121	cubic, pyri	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	4		Coquimbo	Elqui	Coquimbo	Chile
9	NMC	90.245	cubic	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	4					unknown
10	NMC	90.245	cubic	0	0	0	1	1	0	1	0	0	1	1	1	0	0	0	6					unknown
11	NMC	90.246	pyritohed	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	4		Mineral de Angang	Angangueo?	Michoacán	Mexico
12	NMC	90.247	cubic	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	2					unknown
13	NMC	90.361	micro	0	0	0	1	1	0	0	0	0	1	1	1	0	0	0	5	Llantwit Black Vein Collie	Caerphilly		Caerphilly	Wales
14	NMC	10.34.GR.	cubic	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	4				Cornwall	England
15	NMC	10.34.GR.	pyritohed	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	4				Cornwall	England
16	NMC	13.45.GR.	pyritohed	0	0	0	1	1	0	0	0	0	1	1	0	1	0	0	5		Remedios		Antioquia	Colombia
17	NMC	13.45.GR.	pyritohed	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	3		Remedios		Antioquia	Colombia
18	NMC	13.45.GR.	pyritohed	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	4		Remedios		Antioquia	Colombia
19	NMC	13.62.GR.	cubic, agg	0	0	1	0	1	0	1	0	0	1	0	0	1	0	1	6	Ogofau Mine	Llandovery		Carmarthenshire	Wales
20	NMC	14.311.GR	pyritohed	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	4		Bracknell		Berkshire	England
21	NMC	15.156.GR	octohedra	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	4					unknown
22	NMC	15.156.GR	cubic	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	4					unknown
23	NMC	15.156.GR	cubic	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	3					unknown
24	NMC	15.156.GR	cubic, agg	0	0	0	1	1	0	0	0	0	1	1	1	0	0	0	5					unknown
25	NMC	15.277.GR	cubic	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	4					unknown
26	NMC	15.277.GR	cubic	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0			and as for a sec			unknown
27	NMC	15.277.GR	cubic	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0		Locality a	ata trom			unknown

Use as Category or Filter in Pivot Tables

AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	Pyrit
	spec.	rosion	nish	orescence	/der	mbling	cing	akages	cks	_	~	0	ourChange	Local (Cou # of :
Locality	# ef	Cor	Tarı	ĒĒ	Pow	Cru	Flak	Brea	Crai	Dull	Dar	Pale	Cole	Corre
Algeria	4	25%	100%	0%	0%	0%	0%	0%	0%	50%	50%	0%	50%	Tarn
Aotearoa (New Zealan	2	0%	100%	50%	0%	0%	0%	0%	50%	100%	50%	0%	0%	Efflo
Australia	2	0%	100%	50%	0%	50%	0%	0%	50%	100%	50%	0%	0%	Powe
Austria	5	20%	100%	0%	0%	40%	0%	0%	80%	80%	20%	20%	40%	Crun
Bolivia	3	33%	100%	33%	0%	67%	0%	0%	100%	100%	100%	0%	67%	Elaki
Brazil	8	50%	88%	0%	0%	0%	0%	13%	50%	75%	50%	0%	63%	Broo
Canada	9	22%	89%	0%	11%	22%	0%	11%	44%	89%	44%	0%	44%	Died
Chile	3	0%	67%	0%	0%	0%	0%	0%	33%	33%	33%	0%	0%	Crac
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%	Colo
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%	
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%	

rynte						
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%
Breakages	13%	21%	0%	4%	6%	4%
Cracks	56%	70%	40%	57%	31%	66%
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

Locality		# of spec.	1 st Order	2 nd Order	
England	Cornwall	96	Surficial Oxidation	Physical Forces	
	Cumbria	33	Surficial Oxidation	Physical Forces	
	Devon	29	Surficial Oxidation	Oxidation At Depth	
	Kent	13	Surficial Oxidation	Oxidation At Depth	
Italy	Piedmont	49	Surficial Oxidation	Oxidation At Depth	
	Tuscany	57	Surficial Oxidation	Physical Forces	
Peru	La Libertad Department	8	Surficial Oxidation		
Spain	Andalusia	7	Physical Forces		
	La Rioja	11		Physical Forces	
ASU	Colorado	18	Surficial Oxidation	Physical Forces	
	New York	7	Surficial Oxidation		
	Pennsylvania	12	Surficial Oxidation	Physical Forces	
Wales	Carmarthenshire	26	Surficial Oxidation	Oxidation At Depth	
	Ceredigion	15	Surficial Oxidation	Physical Forces	
	Denbighshire	13	Surficial Oxidation	Oxidation At Depth	
	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

- Provide further areas for research
- Reveal previously unknown relationships

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





*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

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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. rightarrow PCs 4 = Ox. at Depth

	4. 9	.504			
	Component				
	1	2	з	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.

42

% of Variance 1. 22.560

2. 14.422

3. 12.408



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!

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Questions?

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