## Applications with tutorials

- 01 Intercepts processing in grey levels of Adamello Batholith images
- 02 SPO basic processing of classified images

## 03 - SPO processing of one classified norite of the Bushveld

- 04 Intercepts processing in greyscale and classified images of Rooi Rand dykes
- 05 Intercepts processing in grey levels of faults and lineaments







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This application uses a set of images of the site 50B from J-B Auréjac (2004) thesis and Auréjac et al. (2003) poster. It is a step by step tutorial of SPO2003 and Ellipsoid2003 programs from 2D images orientation to 3D ellipsoids calculation with useful warning.



Auréjac, J.-B., 2004. Etude pétrostructurale de gabbros lités de la Zone Critique Supe'rieure, Complexe du Bushveld (Afrique du Sud). Thèse de doctorat, Université Paul Sabatier, Toulouse, France.J.B. Aurejac, P.

Launeau, J. Girardeau, J.L. Bouchez (2003) "New Textural constraints on the origin of layered igneous cumulates: the Bushveld Complex case". EGS - AGU - EUG Joint Assembly, Nice, France, April 2003

J.B. Auréjac, P. Launeau, J. Girardeau and J.L. Bouchez (2001) "Evidences for a dynamic formation of the layering in the Eastern Upper Critical Zone, Bushveld Complex, South Africa". EUG XI, 8-12 april 2001, Strasbourg. Bushveld East lob Site 50 Auréjac (2004)







The minerals identification in thin section used the F. Fueten and Goodchild (2001) rotating polarizer stage allowing the identification of orthopyroxene (opx) as summarized in this sketch.

# Maximum polarized light



Natural light



Directions of maximum light intensity





CPX color index



Mask of plagioclase + CPX









A computer-controlled rotating polarizer stage for the petrographic microscope. Computers & Geosciences, 23, 203–8. *Fueten, F. & Goodchild*, J.S. (2001)

Isolated OPX

The set of images is composed of 3 perpendicular thin sections taken on the block sample 50B. All orthopyroxene (opx) crystals were classified and segmented by Auréjac (2004). This set of images was reprocessed with the new version of SPO published in 2005 with 9 masks of measurement (see course 6 p 10 and Launeau and Robin (2005)).



Let now start the program SPO2003



And click on the "New image" button

A standard dialog box appears for the selection of the bitmap image on your system.



snape Preferred	Orientation		
File Preprocessing	g (phase A) Example	es Option Help	
image SPO			
columns ines scale	C Selection Ri G	Pair     C Era:     O Dra	nt Color se Background
Load SPO Sav ➔ New image	ve SPO Bi Image in	mage screen	detail 10
Image	Phases	Inertia	Intercepts
			🔽 palette



First, type the size of the image width : 4.5 here and click enter to visualize the scale. Select also the unit : cm.

You may zoom back on the image to visualize its full area like in this example with a magnification divided by 2.

Then click on one opx to select its color code. Default is black RGB(0, 0, 0) but any color can be used with the exception of the RGB(255,255,255) white reserved for the background making future impressions or windows metafiles building easier.

Shape Preferred	Orientation			×
File Preprocessing	(phase A) Examp	oles Option	Help	
image  :\Cours ima SP0	agerie\Applications\5	0BXZ.tíf		
columns 2203 lines 568 scale 0.002043 Load SPO Sav New image	4.5 cm ▼ Xi Yi C Selection Ri e SPO Bi Image	597         597           429         429           0         0           0         0           0         0           0         0           image         screen	Copy image	Color Background 1 zoom 1 detail /4 /2
Image	Phases	Iner	tia	Inter x1 k3
•••• •			<b>v</b>	palette x4

🔄 Selection	×
3274 pixels	OK

The program automatically looks for all neighboring pixels and a window pop up with their count.



You are now ready to enter the selected color of the phase A Add eventually a caption: OPX

Click with left button on the < button. A right click on the same button would delete the image phase or class.

🔊 Shape Pre	eferred Orientation	X
File Prepro	ocessing (phase A) Examples Option Help	
Start 🔨	Mean shape /A E Grain size Shape ×1 🔽	tensor ellipse
>> Ellipsoid	Mean tensor /A E Image segmentation	box
Print	Cosime 1 - Rf-phi Center-center 1 - V	circle b
	Tensor     Obj. num.       Image orientation       → I × 270	je wmf ohase
Image	Phases <b>Inertia</b> Interce	epts
••••		
		$\overline{}$

Shape Preferred O	rientation		×
File Preprocessing (	phase A) Example	es Option Help	
cm Scale	mask no 💌	objects area 🔽 + bo	order 🔲 av grain
ase A with current color	or apply a new colo	r (Left Bt) - Remove a	phase, turn it white (Rig
E F			
П G [ П Н ]			
Image	Phases	Inertia	Intercepts
••••			🗸 palette

Select tab Inertia and enter the image internal orientation.

You can now click on Stat button.

This activates the other buttons allowing different processing.

Shape Preferred Orientation										
File Preproc	File Preprocessing (phase A) Examples Option Help									
Start	Mean shape	/A E	Grain size Shape	v a v tensor						
>> Ellipsoid	Mean tensor	/A E	Image segmentation	box						
Print	Cosine directions	Rf-phi	Center-center 1 -							
5       Angular       Image       Image       Image       0bi; num.       0.1       cm       -> image       wmf         15°       Image       Image       riset       Tab       object       0       phase         Image       secondary       Image       ovientation       -> image       orientation       -> image       omage         Image       orientation       -> Image       orientation       -> image       orientation										
Image	Image Phases Inertia Intercepts									
••••				✓ palette						



Default internal image orientation 0 / 0 / 0 compatible with NED

Each opx crystal now has a color code of orientation. Moving the mouse pointer on it allows to visualize object number #, shape ratio r, default image orientation angle, phase/class letter and associated color here

A click on one object pop up a new window focused on that object with results display.

х Shape Preferred Orientation File Preprocessing (phase A) Examples Option Help tensor Shape Start Mean shape Grain size F 2 ellipse >> Ellipsoid 7 Mean tensor /A E Image segmentation box Circle Cosine Print Rf-phi Center-center Ь direction Angular 🔽 histo Tensor 👻 Obj. num. 0.1 image wm 🔽 rose Tab phase Image orientation secondary 🔽 even 2.01 ▼ × 270 +90 🔻 ✓ odd directions angle [ 76.0 Image Phases Inertia Intercepts 🔽 palette



Shape Preferred Orientation

Scale

Preprocessing (phase A) Examples Option Help

<

<

<

objects area 🥅 + border

48.9%

949

mask no 🔻

File

1

cm

A OPX

F B

Click on tab "Phases" to change the color code.

All cut objects have been erased for inertia tensor calculation so modal fraction are biased by missing areas. The thickness of the boundaries between objects also biases that modal fraction.

![](_page_8_Figure_3.jpeg)

50BXZ.tif

- • ×

х

🔲 av grain

direction

object palette-

C. no

C.

![](_page_8_Figure_6.jpeg)

![](_page_9_Figure_1.jpeg)

Go back to Inertia and click on "Mean shape" to visualize it.

![](_page_10_Picture_2.jpeg)

![](_page_10_Picture_3.jpeg)

Shape Preferred Orientation
File Preprocessing (phase A) Examples Option Help
Start Mean shape /A E Grain size Shape // ellipse
>> Ellipsoid Mean tensor 😵 /A E Image segmentation 📄 🔽 box
Print Stack objects on their gravity centerenter 5 • Angular  FH
Image of endation       Imag
Image Phases Inertia Intercepts
v palette

One click on button "/ A" calculates the mean shape of crystals weighted to their surface area giving results without scale (left below) and one click on button "E" replaces each inertia tensor by its corresponding inverse shape matrix for the calculation of mean shapes proportional to the smaller crystals (right below).

![](_page_10_Picture_6.jpeg)

Click on ">> Ellipsoid" button to pop up the window	Shape Preferred Orientation
of exportation of the data to Ellipsoid.	File Preprocessing (phase A) Examples Option Help
	Start     Mean shape     /A     E     Grain size     Shape       >> Ellipsoid     Mean tensor     /A     E     Image segmentation
Enter the initial relative orientation of the block sample section which is $0/00$ for (VZ). The roles some from	Data format for Ellipsoïde 2003
the internal orientation of the image	Data format Weight 2-D face(XY) Orientation
the internal orientation of the image.	C shape ratio C 1 strike 0 (XY) image orientation
	C +density C N pitch/rake 0 [X] direction on the (XY) plan
By default the exportation concerns short and long axis	G short - long axis     ⊂ Copy format
of mean snapes which can be calculated from inertia	2-D mean type Set Z C from the phase selection and with odd
tensor to bounding box by a click on its corresponding	C /A C Rf ellipse
checkbox.	Cellipse C Rf box → Image wmf Xi / 3 ▼ Yi / B ▼ □ visible
	Copy Cd considering phases as data sectors to be
Then select the number of windows of measurement	caption Ellipsoid2003
allowing to evaluate the invariance of the results with	
translation. A cut of $3 \times 3$ windows gives a total of 9	
windows of measurement which can be visualized by a	
click on visible checkbox.	
the second of th	

![](_page_11_Figure_2.jpeg)

All windows of measurement overlap 50% with their neighbors.

Click now on "Tab" button to pop up the table and on "Transfer" button to send the data into it.

T	ablea	u								<b>E</b>
lΓ		#	strike	dip	rake	long axis	short axis	weight	хс	ус
	1	1XZ	0	90	88.825	0.074362	0.056504	1	550.75	142.00
	2	2×Z	0	90	85.859	0.073862	0.056808	1	1101.50	142.00
	3	3XZ	0	90	86.552	0.071123	0.055281	1	1652.25	142.00
$\ \ $	4	4×Z	0	90	87.964	0.074931	0.058350	1	550.75	284.00
11	5	5×2	0	90	85.417	0.075052	0.057694	1	1101.50	284.00
$\ \ $	6	6×Z	0	90	87.382	0.073199	0.056280	1	1652.25	284.00
$\ \ $	- 7	7XZ	0	90	91.414	0.072140	0.057274	1	550.75	426.00
	8	8×Z	0	90	93.567	0.071497	0.056314	1	1101.50	426.00
	9	9×Z	0	90	91.926	0.071571	0.055313	1	1652.25	426.00

![](_page_12_Figure_3.jpeg)

While "visible" is checked click on any table row to highlight the position of the corresponding area with a negative window.

![](_page_12_Figure_5.jpeg)

It is recommended to save its work before continuing with the next step. The file saved contain the image, all calculations and all orientations.

Shape Preferred Orie	ntation		×
File Preprocessing (ph	ase A) Example	s Option Help	
image  :\Cours imageri SPO title	Applications\508	XZ.tif	
columns 2203 4.5 lines 568 scale 0.002043 C Load SPO Save SP New image Ima	Cm Vi 1 Yi 5 Pelection Ri 2 Gi 2 Bi 2 ge in	742         1742         Pa           162         562         Erc           155         255         Dr           155         255         Cop           155         255         Cop           155         255         Cop           155         255         mag           138e         screen         The	int Color ase Background aw 1 v y zoom /2 v ge detail 10
Image	Phases	Inertia	Intercepts
••••			🔽 palette

It is also recommended to save all SPO file (xy), (xz) and (yz) prior 2D exportation towards the 3D Ellipsoid program.

While the Table is visible click on "Copy".

Open Ellipsoid (or select it if it is already open) and click on "Paste" for the first file.

Then click on "Add" for the two other sections. The ellipsoid calculation require a minimum of 3 sections roughly perpendicular to each other.

![](_page_13_Picture_4.jpeg)

You must click at least one time on "Ellipsoid" (which pop up the window below) to calculate it and save your work by a click on "Save" in a file \*.elli

![](_page_13_Figure_6.jpeg)

Data format for Ellipsoïde 2003								
Data format       Question         C shape ratio       Image         C shape ratio       Image         C +area       Image         C +density       Image         Short - long axis       Set         2-D mean type       Set         Image       Tab         Transfer       -> Image         Image       wmf         C a ellipse       C a box	ce(MY) Drientation rike 0 dip 90 ake 0 (MY) image orientation ake 0 (M) direction on the (MY) plan Copy format C from the phase selection and with odd and even sub-populations from sub-populations divided in sectors : Xi / 3 ↓ Yi / 8 ↓ visible considering phases as data sectors to be C combined with each others in Ellipsoid2003							

Tab	ole		1.0	-	1.00	1000	- mark	×
		#	strike	dip	rake	long axis	short axis	1 weight
N	1	1XZ	0	90	178.825	0.074329	0.056479	1
	2	2×Z	0	90	175.928	0.073710	0.056733	1
	3	3XZ	0	90	176.552	0.071091	0.055256	1
/ / /	4	4×Z	0	90	177.964	0.074897	0.058324	1
1 Paste	5	5×2	0	90	175.429	0.074740	0.057472	1
	6	6×Z	0	90	177.382	0.073166	0.056254	1
	- 7	7×2	0	90	1.414	0.072107	0.057248	1
	8	8×Z	0	90	3.519	0.071191	0.056118	1
V	9	9XZ	0	90	1.926	0.071539	0.055288	1
N	10	1XY	0	0	173.581	0.068726	0.064389	1
	11	2XY	0	0	168.315	0.068935	0.062016	1
	12	3XY	0	0	167.637	0.067479	0.060539	1
	13	4XY	0	0	126.413	0.072759	0.069820	1
2 Add	24	5XY	0	0	156.967	0.072879	0.069395	1
	15	6XY	0	0	177.676	0.067253	0.063026	1
	16	7XY	0	0	134.074	0.077423	0.068260	1
	17	8XY	0	0	138.117	0.072920	0.067271	1
V	18	9XY	0	0	8.568	0.066547	0.063760	1
	19	1YZ	90	90	167.169	0.066126	0.053881	1
	20	2YZ	90	90	171.426	0.065930	0.052756	1
	21	3YZ	90	90	170.924	0.065915	0.054058	1
\	22	4YZ	90	90	167.276	0.065138	0.055935	1
3 Add	23	5YZ	90	90	164.343	0.065131	0.055251	1
	24	6YZ	90	90	161.934	0.064138	0.054837	1
	25	7YZ	90	90	178.094	0.064778	0.056345	1
	26	8YZ	90	90	173.362	0.063843	0.056395	1
	27	9YZ	90	90	172.920	0.064767	0.055055	1

The use of internal 0/0, 0/90 and 90/90 block sample section's orientation the program automatically selects the right combination of section.

If the frame "Combinations" is empty use "Option" menue to select the right code of section family 1 2 3 or A B C or YZ XZ XY. For instance in this example one could select YZ XZ XY.

The "Test sections" button run a routine checking the compatibility of the sections. 3 parallel sections cannot retrieve a 3D ellipsoid which have to be as perpendicular as possible.

 $3 \times 3$  windows per image section  $\times 3$  sections give  $9^3 = 729$  potential combinations of ellipsoids.

So, check "active" to activate the calculation of the 729 combinations, then click again on "Ellipsoid".

Ellipsoid 2003				×
File Option Contac	t Examples (see Ref. 2)	Rotation [xyz]		
Number of section 3 display section # symbol o • P'	Calculation Calculation WITH measure WITHOUT measure Combinations	d scale factor 🔽 /me asured scale factor 🗖 3 se , 🗌 display (x) (y) (z)	an L ctions	L <mark>0.0643</mark> Help Quit Delete all
C shape ratio r	active	Pole of the section	Paste	Load
C +surface	N 729	strike n	Add	Bedding
C +density	🗖 density 🕺 <mark>50 🖵</mark>	dip 0	Test sections	Ellipsoid
Iong & short axis	<mark>α° 15 ▼</mark> L <b>1 ▼</b>	pitch/rake 0	Copy results	Save

差 Ell	ipsoi	d 2003	X
File	Opt	ion Contact Examples (see Ref. 2)	Rotation [xyz]
Numb		Français	ale factor /mean L
displ	✓	English	d scale factor 3 sections
symo ⊢Da	$\checkmark$	F <sup>1</sup> / <sub>2</sub>	display [x] [y] [z] Delete all
0		e(section/ellipsoid)	otation Paste Load
		Р	strike 0 Add Bedding
	$\checkmark$	P'	tch/rake 0
		К	
_		Combinations	
		Full display	
		minimum	
	$\checkmark$	maximum	
	✓	VEW VNS HNE	
		1 2 3	
		with n sections per XYZ sector	
		Density	
	$\checkmark$	Filled polygons	
		Counts alone	
		Polygons and counts	
		High resolution	
		AMS data processing	10

This output is in the relative block sample orientation 0 / 0 / 0

It is now necessary to rotate it at once in the geographic coordinate system with the strike dip rake of the top (xy) of the block sample and the rake orientation of [x] on that plane.

Geographic block sample orientation is 317 / -10 / -10 137 / 10 / 170

![](_page_15_Figure_4.jpeg)

Calculation	WITHOU	T scale fac	ctor			*									
Caption						Table							<b>E</b>		
Distribution	N. faces	Inver	se Shape	Matrix	a second		#	strike	dip	rake	long axis	short axis	1 weight	without	e(ab)
1.00	27	12.48	.5521	.1822		1	1XZ	0	90	178.825	0.074329	0.056479	1	2.9%	
_		.5521	14.22	1.010		2	2×Z	0	90	175.928	0.073710	0.056733	1	2.7%	
$\sqrt{\tilde{F}}$	2.6%	.1822	1.010	19.99		3	3×Z	0	90	176.552	0.071091	0.055256	1	1.9%	
		A	В	C		4	4≫Z	0	90	177.964	0.074897	0.058324	1	1.2%	
E	igenvalue	12.32	14.20	20.17		5	5~2	0	90	175.429	0.074740	0.057472	1	3.0%	
	North	0.958	0.285	0.036		6	6×2	0	90	177.382	0.073166	0.056254	1	2.2%	
Dir. Co	s. East	-0.287	0.943	0.170		7	7%2	0	90	1.414	0.072107	0.057248	1	1.9%	
	Down	0.015	-0.173	0.985	- 444 -	8	8~2	0	90	3.519	0.071191	0.056118	1	3.3%	
	NTMI	0722	0673	0564		9	9×2	0	90	1.926	0.071539	0.055288	1	2.9%	
	Norm 1	1 112	1.035	0.869		10	1XY	0	0	173.581	0.068726	0.064389	1	1.8%	
S, Wmf	Trend	343.3*	253.2°	78.2*		11	2XY	0	0	168.315	0.068935	0.062016	1	2.2%	
	Plunge	0.9*	10.0*	80.0*	Nigh.	12	3×1	0	0	167.637	0.067479	0.060539	1	2.3%	
C. Bmp	, lange	0.0	10.0	00.0		13	4×1	0	0	126.413	0.072759	0.069820	1	5.3%	
Print	A/C	1.280	Flinn	0.385		14	5XY	0	0	156.967	0.072879	0.069395	1	2.2%	
(*************************************	A / B	1.074	P'	1.290		15	6XY	0	0	177.676	0.067253	0.063026	1	2.5%	
Сору	B / C	1.192	Т	0.424		16	7XY	0	0	134.074	0.077423	0.068260	1	7.4%	
Foliation	168.2*	10.0°	Litake	175.1*	COME THE REAL PROPERTY OF	17	884	0	0	138.117	0.072920	0.067271	1	4.7%	
1 Olidion	100.2	10.0	Endito	110.1		18	9XY	0	0	8.568	0.066547	0.063760	1	4.0%	
A/C 1.2	90 ±0.0	50 Flinn	0.477	±0.440	1	19	1YZ	90	90	167.169	0.066126	0.053881	1	2.7%	
A/B 1.0	85 ±0.0	57 P'	1.299	±0.051	THE REAL PROPERTY OF THE PROPERTY OF THE REAL PROPE	20	2YZ	90	90	171.426	0.065930	0.052756	1	3.5%	
B/C 1.1	89 ±0.0	59 T	0.365	±0.375		21	3YZ	90	90	170.924	0.065915	0.054058	1	1.5%	
$\sqrt{3}$	õ	۵	в	C I		22	4YZ	90	90	167.276	0.065138	0.055935	1	2.9%	
27	7% I	1 118	1.031	0.867	T_	23	5YZ	90	90	164.343	0.065131	0.055251	1	3.4%	
+3	5%	+0.029	+0.032	+0.021		24	6YZ	90	90	161.934	0.064138	0.054837	1	4.8%	
ARC aves	Trend	344.8*	254.7*	78.4*		25	7YZ	90	90	178.094	0.064778	0.056345	1	5.1%	
distribution	Plunge	0.7*	9.9*	80.1*	1	26	8YZ	90	90	173.362	0.063843	0.056395	1	5.0%	
		+28.8*	+28.8*	+8.7*		27	9YZ	90	90	172.920	0.064767	0.055055	1	2.0%	
🗌 gc 🛛 2	▼ <sub>62</sub>	+5.6*	+8.7*	+5.7*		·   L									
N 72	9	displau a			1.00 1.05 1.10 1.15 1.20 1.25 1.30 1.35 1.40										
729 ellipso	ide 💌	alopidy 0													

Geographic block sample orientation is 317 / -10 / -10 137 / 10 / 170

Both orientation give the same results. The main axis of the block sample are visualized with this checkbox.

As mentioned p. 4 the axis [y] is plunging upwards towards the NE with a negative angle. This is highlighted here with a red Y-1 warning in the graphic.

The ellipsoid is now in the geographic coordinate system and can be save again for recording its new orientation.

Eigenvalues are calculated on inverse shape matrix as shown by their invers order of intensity.

See course 6 p. 11 to 13 for comments.

Save a windows metafile of the plot with A bitmap of it with \_\_\_\_\_\_ Copy the results with \_\_\_\_\_\_ see next page.

![](_page_16_Figure_8.jpeg)

				N F	27 2.57E-02		
Eve	mnla	of output			Δ	В	C
EAG	unpie	of output	-	nLenght	1.111545452	1.035640723	e
Cli	ck on	one row of	the following table of incompatibility index to	strike	290.8441197	199.0240267	
vis	lalize	the results	of one section	dip	5.314386645	18.85216132	
			Rake shape ratio of the Ellipsoid section	aLength	7.22E-02	6.73E-02	5.64E-02
	Cor	ntribution of t	he sample with rake and shape ratio	F-L	125.9515164 164.0056822	19.64185573	
				ac	1.28		
1			Section # 16 : 137.0" / 10.0" / 124.1" : 1.13 (153.8" : 1.08)	ab	1.073		
F <sup>1</sup> /2		<b>X</b>		bc	1.192		
	with	without e(ab)		Р	1.28943551		
1 B		2.9%		Т	0.426170707		
28		2.7%					
3 B		1.9%			А	В	С
4 B		1.2%		Ln	1.11820286	1.031494102	
5 B		3.0%			0.867230022		
6 B		2.2%		S	1.45E-02	0.016252802	1.04E-02
7 B		1.9%		strike	292.2517468	200.5477233	
8 B		3.3%	1.13 @124.1°		36.12803405		
<u>98</u>		2.9%		dip	4.884473879	18.91262228	
100		1.8%			70.46731061		
<u>110</u>		2.2%	it is a second sec	s1	14.47611052	14.46166044	
120		2.3%			4.329446532		
130		5.3%	X1 X1	s2	75.24195685	74.86922383	84.8103036
14 0		2.1%	Yi Yi	ac	1.289615912	2.50E-02	
100		2.3%		ab	1.084465021	2.86E-02	
17.0		4.7%	Rotation 137.017 10.017 170.01	bc	1.189727023	2.96E-02	
18.0		4.0%		Ρ'	1.299137479	2.56E-02	
19A		2.7%		Т	0.367685085	0.187870264	
20 A		3.5%					
21 A		1.5%					
22 A		2.9%	T-				
23 A		3.4%					
24 A		4.8%					
25 A		5.1%					
26 A		5.0%	-1				
27 A		2.0%					
1	_		1.00 1.00 1.10 1.10 1.20 1.20 1.30 1.30 1.40				
			output example of C. Bmp				

#### Example of output

Click on one row of the following table of ind index to visualize the results of one section

Sections

4 5XZ 5

6 7XZ

10 1XY

11 2XY

12 3XY

13

14 5XY

15 6XY

16 17 8XY

18 9XY

19 20 1YZ

21 3YZ

22 23 24

25 26

27 9YZ

#

1XZ

2XZ

3XZ

4×Z

6×Z

8×Z 8

9XZ 9

 $4 \times Y$ 

2YZ

4YZ

5YZ

6YZ

7YZ

8YZ

az

306.8

306.8

306.8

306.8

306.8

306.8

306.8

306.8

306.8

137.0

137.0

137.0

137.0

137.0

137.0

137.0

137.0

37.1

37.1

37.1

37.1

37.1

37.1

37.1

37.1

37.1

					able								
				I	1	#	العلم	.	die		long suis	short suic	1 maiele
				- 11		1/7		e	aip	170.00E	0.074229	0.0EC479	
					2	1/2 2/2	0		90	176.623	0.074323	0.056722	1
				- 11	2	3/7	0		90	175.526	0.073710	0.056755	1
·		1. :1:4		- 11	3	3/2	0		00	176.332	0.071031	0.050206	1
inco	mpau	binty		- 11	5	4/VZ	0		90	175.429	0.074037	0.050324	1
า					6	6VZ	0		90	177.382	0.073166	0.057472	1
				- 10	7	7/2	0		90	1 /1/	0.072107	0.050234	1
						8/7	0		90	3,519	0.072107	0.056118	1
					9	9/2	0		90	1.926	0.071539	0.055288	1
					10	152	0		0	173 591	0.069726	0.053200	1
				- 10	11	200	0		0	100.001	0.000720	0.064383	1
					12	201	0		0	167.627	0.060333	0.062018	1
					12	100	0		0	107.037	0.007475	0.060333	1
					14	=01 5XV	0		0	120.413	0.072735	0.063620	1
					14	- 361 6522	0		0	177.676	0.072073	0.063333	1
					10	7	0		0	124.074	0.007233	0.063026	1
					17	822	0		0	139.117	0.077423	0.000200	1
					17	0/1	0		0	130.117	0.072520	0.067271	1
											3 D.066547	0.063760	1
nl	rake	r	rake 1	r 1	e1	rake 2	12	e2	rake 3	r3 e3	0.066126	0.053661	1
80.2	0.6	1 316	Take 1			0.4	1.266	4 4%	Take o	10 00	0.065330	0.052756	1
80.2	177.7	1.010				0.4	1.266	3.2%			0.065315	0.054036	1
80.2	178.3	1.200				0.1	1.266	2.0%			0.005130	0.055355	1
80.2	179.7	1.284				0.1	1.266	1.6%			0.003131	0.053231	1
80.2	177.2	1.300				0.4	1.266	3.3%			0.064730	0.054037	1
80.2	179.1	1.301				0.4	1.266	31%			0.063843	0.056395	1
80.2	32	1,260				0.4	1.266	1.3%			0.064767	0.055055	1
80.2	5.3	1.269				0.4	1.266	2.0%			0.004707	0.0000000	· ·
80.2	3.7	1.294				0.4	1.266	2.9%					
10.0	163.6	1.067				153.8	1.080	1.7%					
10.0	158.3	1.112				153.8	1.080	3.1%					
10.0	157.6	1.115				153.8	1.080	3.4%					
10.0	116.4	1.042				153.8	1.080	5.1%					
10.0	147.0	1.050				153.8	1.080	3.0%					
10.0	167.7	1.067				153.8	1.080	2.1%					
10.0	124.1	1.134				153.8	1.080	7.3%					
10.0	128.1	1.084				153.8	1.080	3.5%					
10.0	178.6	1.044				153.8	1.080	4.3%					
88.3	157.3	1.227				160.5	1.198	2.8%					
88.3	161.6	1.250				160.5	1.198	4.7%					
88.3	161.1	1.219				160.5	1.198	1.9%					
88.3	157.4	1.165				160.5	1.198	3.2%					
88.3	154.5	1.179				160.5	1.198	2.5%					
88.3	152.1	1.170				160.5	1.198	3.6%					
88.3	168.2	1.150				160.5	1,198	4.9%					
88.3	163.5	1.132				160.5	1,198	6.1%					
88.3	163.1	1.176				160.5	1.198	2.1%					

F1/2								
	with	without	e(ab)					
1 B		2.9%						
2 B		2.7%						
3 B		1.9%						
4 B		1.2%						
5 B		3.0%						
6 B		2.2%						
7 B		1.9%						
8 B		3.3%						
9 B		2.9%						
10 C		1.8%						
11 C		2.2%						
12 C		2.3%						
13 C		5.3%						
-14 C		2.1%						
15 C		2.5%						
16 C		7.4%						
17 C		4.7%						
18 C		4.0%						
19 A		2.7%						
20 A		3.5%						
21 A		1.5%						
22 A		2.9%						
_23 A		3.4%						
24 A		4.8%						
25 A		5.1%						
26 A		5.0%						
27 A		2.0%						

Shape Preferred Orientation (OCW-UN-SPO) Launeau P. 2017

![](_page_19_Figure_1.jpeg)

N 729

729 ellipsoid

V display

20

1.00 1.05 1.10 1.15 1.20 1.25 1.30 1.35 1.40 1.45

Ellipsoid 2003				×
File     Option     Contact       Number of section     27     16       display section #     16       symbol     •     P'       Data format     C     shape ratio r       C     shape ratio r     +surface       C     +density	t Examples (see Ref. 2) Calculation WITH measure WITHOUT measure Combinations Combi	Rotation [xyz] d scale factor	ections mean Paste Add Test sections	L 0.0643 Help Quit Delete all Load Bedding Ellipsoid
Iong & short axis	<mark>α° 15 ▼</mark> L <mark>1 ▼</mark>	pitch/rake 170	Copy results	Save

Calculation of unweighted (L set to 1) data density with a Gaussian function normalized to 50% of the data and having 15° width at mid height

![](_page_20_Figure_3.jpeg)

Example of output via windows metafile open in a drawing software

![](_page_20_Figure_5.jpeg)

![](_page_21_Figure_1.jpeg)

An other possible output in 2D, not recommended for 3D transfer (!), but useful for the analysis of local orientations.

![](_page_22_Picture_2.jpeg)