



行政院農業委員會水土保持局
Soil and Water Conservation Bureau, COA



現地地表地質調查及App介紹

技術研發小組 葉柏村 報告

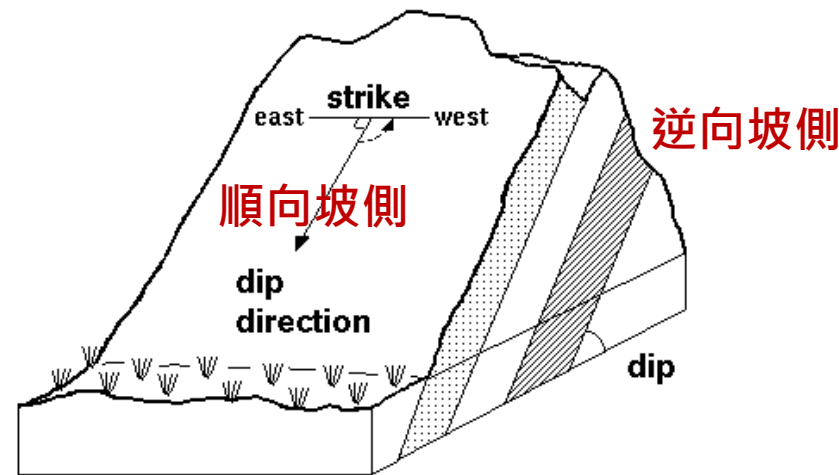
109年7月28日

露頭？

- 固結的底岩穿出地表而顯露於地面的部分就叫做**露頭** (outcrop)
- 地表一般覆蓋著新近生成的土壤或沖積層(alluvium)，大半是仍在繼續形成中。底岩則包括許多較古形成的岩層，它的出露地面，多因地質構造的原因，或者是侵蝕作用的結果，所以它在地面的露頭不是「表淺的」，而是「**根連的**」，可表示該地區地質構造型質的意義。

找尋露頭的有利地點

- 凡是在侵蝕作用強烈或顯著地點，即有發現露頭的希望。
- ① 在幼年期或壯年期之河道兩側。
- ② 坡度峻急地方，常少表土。
- ③ 在峽谷地帶。
- ④ 懸崖面上。
- ⑤ 山脊或稜線上。
- ⑥ 對同一座山而言，逆向坡側比順向坡側較易發現露頭。
- ⑦ 道路切面、採石場岩壁，以及溝壕地道等人工切面之類。
- ⑧ 海岸地區的海蝕崖與波蝕台。





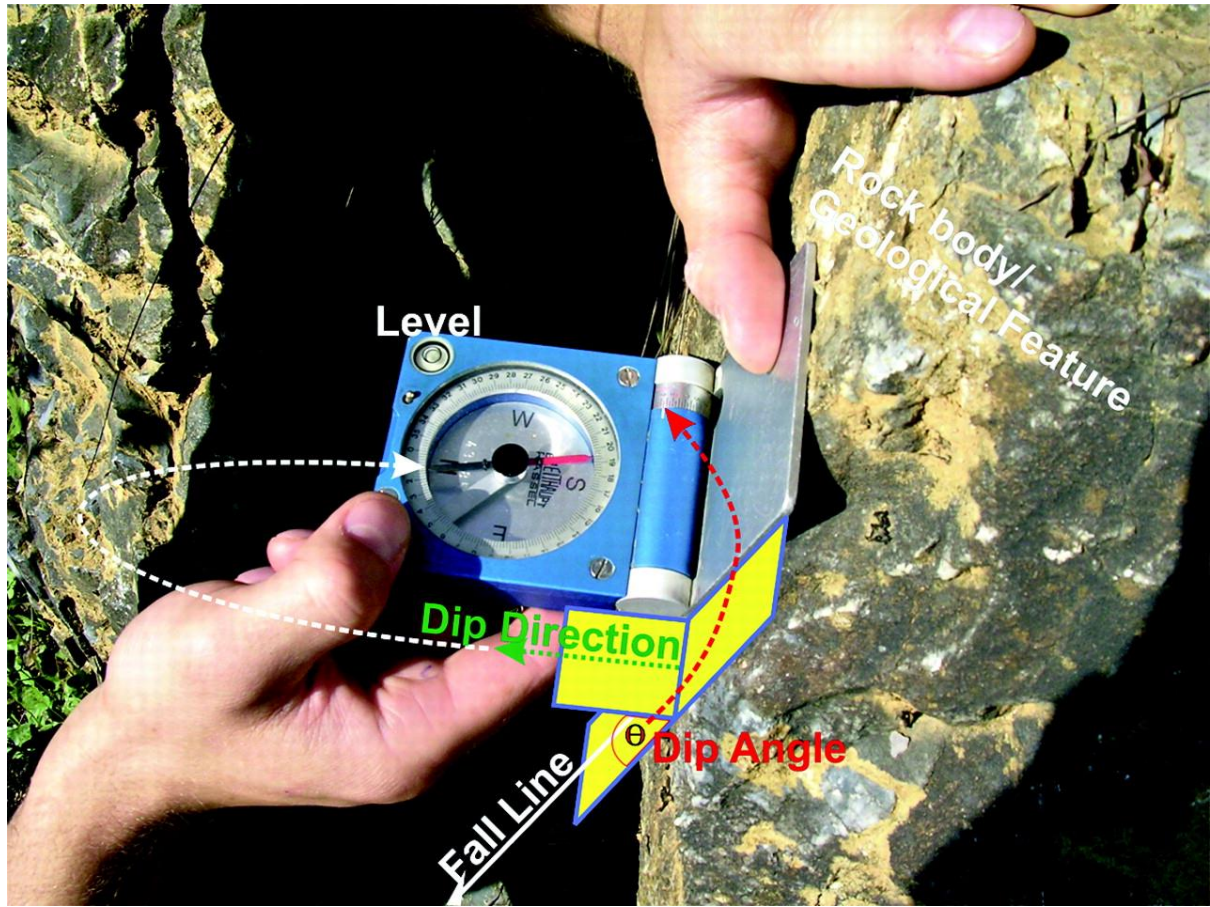
真偽露頭的判別

- 半埋於地下之巨礫，宛如孤立露頭，可能誤認崩移或潛移之岩層為原地露出之底岩。所以遇到零散露頭時，須先環察周圍情形，判定其真偽，然後再做其他岩性等之觀測。**若為一堆真正的零碎露頭，在其間每多彼此連續性和一致性**(例如岩性或地層走向等性質)的存在。



野外調查常備工具

- 地質圖
- 地形圖
- 地質羅盤
- 地質錘
- 記錄簿
- 放大鏡
- 照像機
- 史密特硬度錘
- 土壤硬度計
- 望遠鏡
- 比例尺
- 標準色卡
- 標本袋
- GPS定位儀
- 雷射測距儀
- 高度計
- 鹽酸

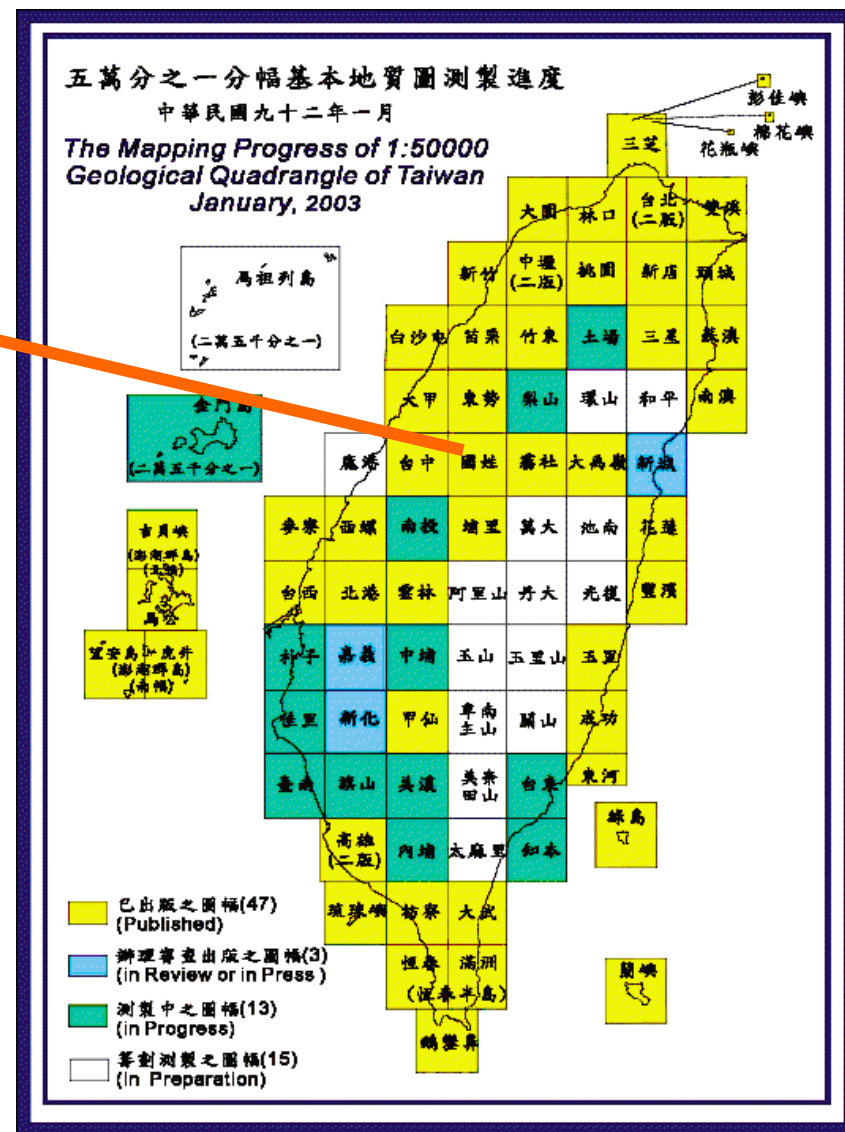
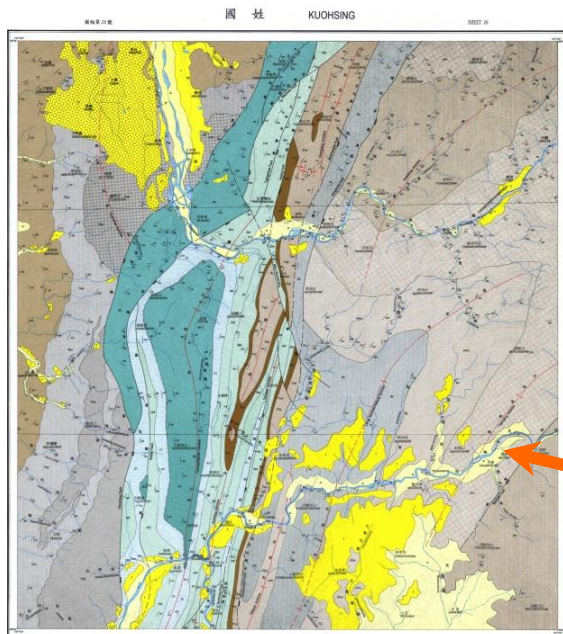




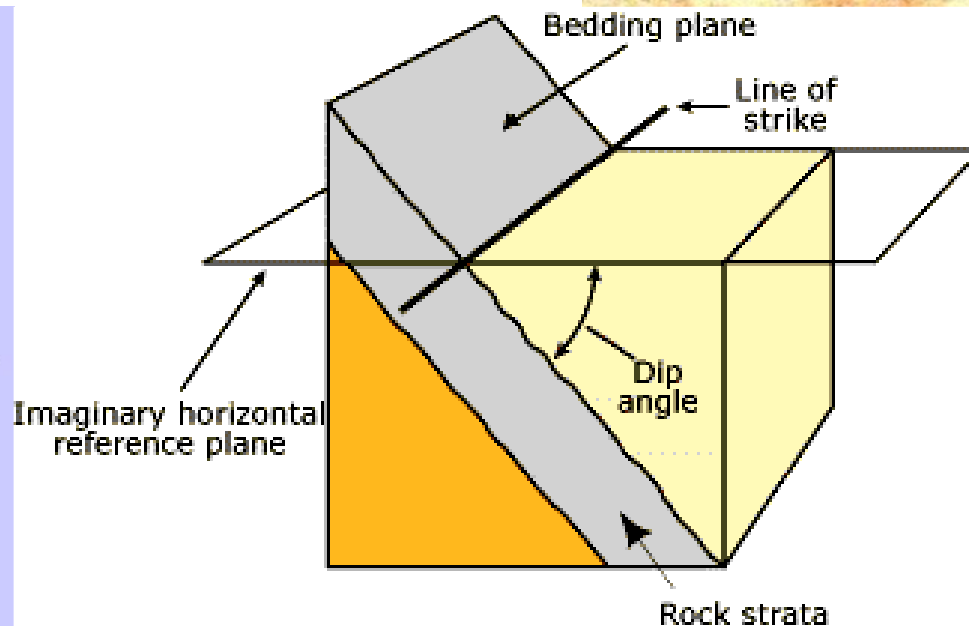
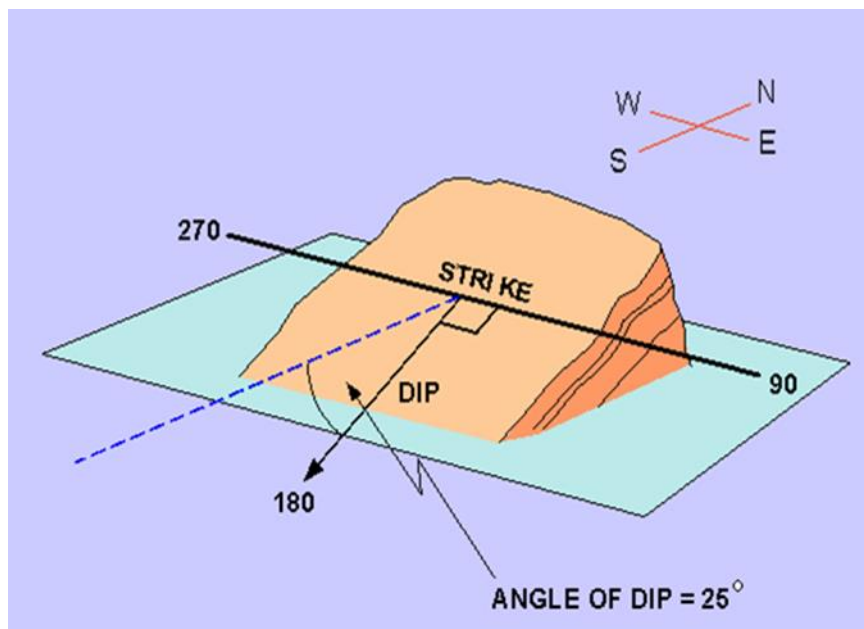
調查重點

- 露頭 + 定位
- 地質材料：地層名、年代、岩性、粒度、風化程度、材料強度
- 地質構造：褶皺軸和斷層位置之確認、不整合、弱面(層面、節理、劈理、剪裂帶、張裂縫)位態、厚度、互層
- 弱面之描述與評估：位置、組數、方位、延續性、粗糙度、內寬(開口)、軟弱夾心、滲水狀況
- 地形和地表或地下水情形：乾/溼、地下水位、集水區大小、河流情況(侵蝕岸、堆積岸)
- 崩塌：崩落地點、大小、定位、機制
- 擋土牆、植生：構造物、林種、植物覆蓋情況
- 照相、描繪：將觀察重點繪出或照相

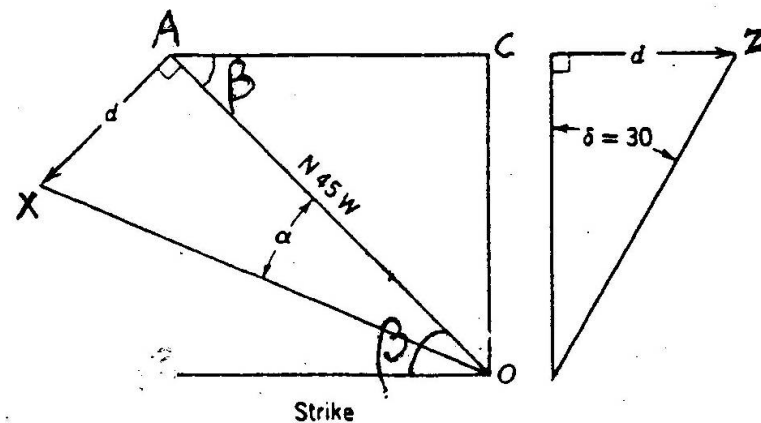
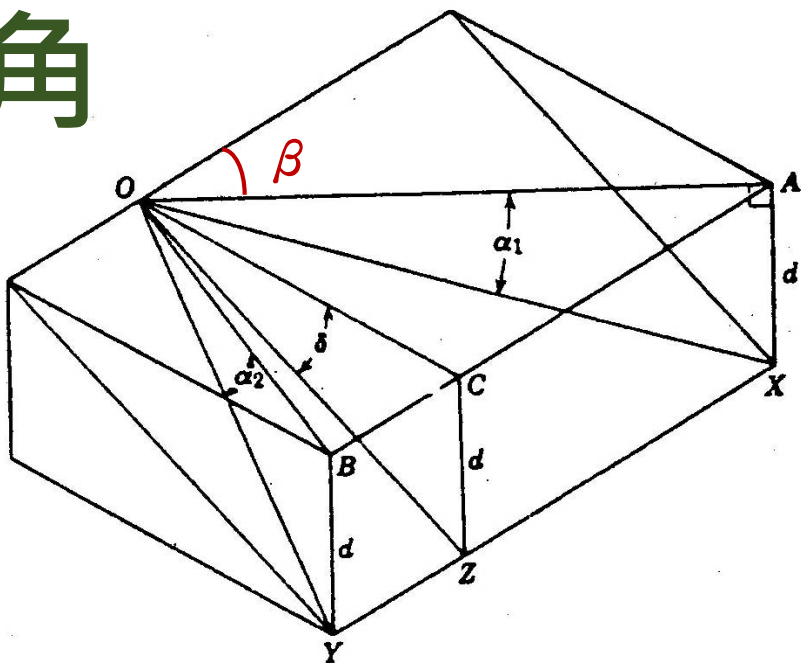
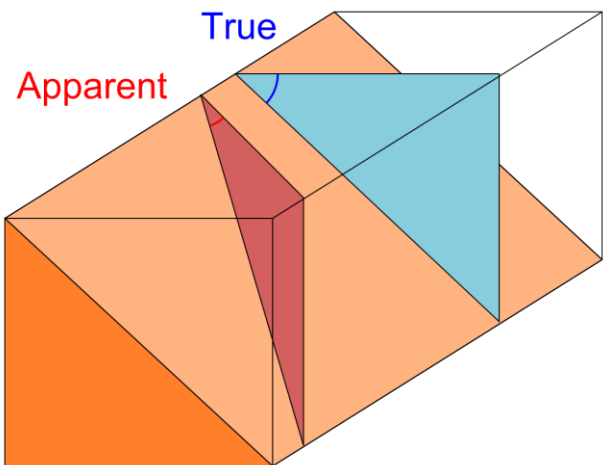
• 1/50000地質圖(分幅) (經濟部中央地調所)



Dip Angle (Angle of Dip)



真傾角與視傾角



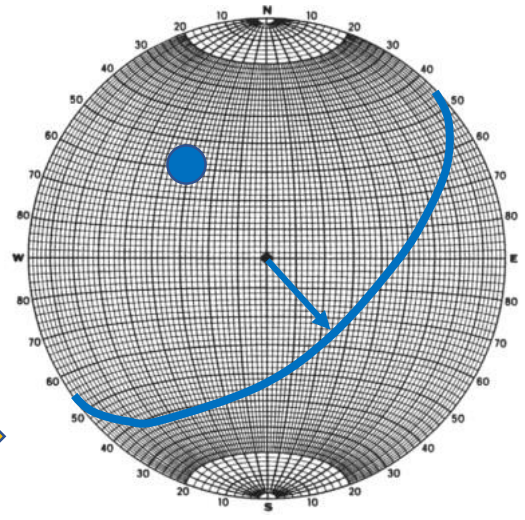
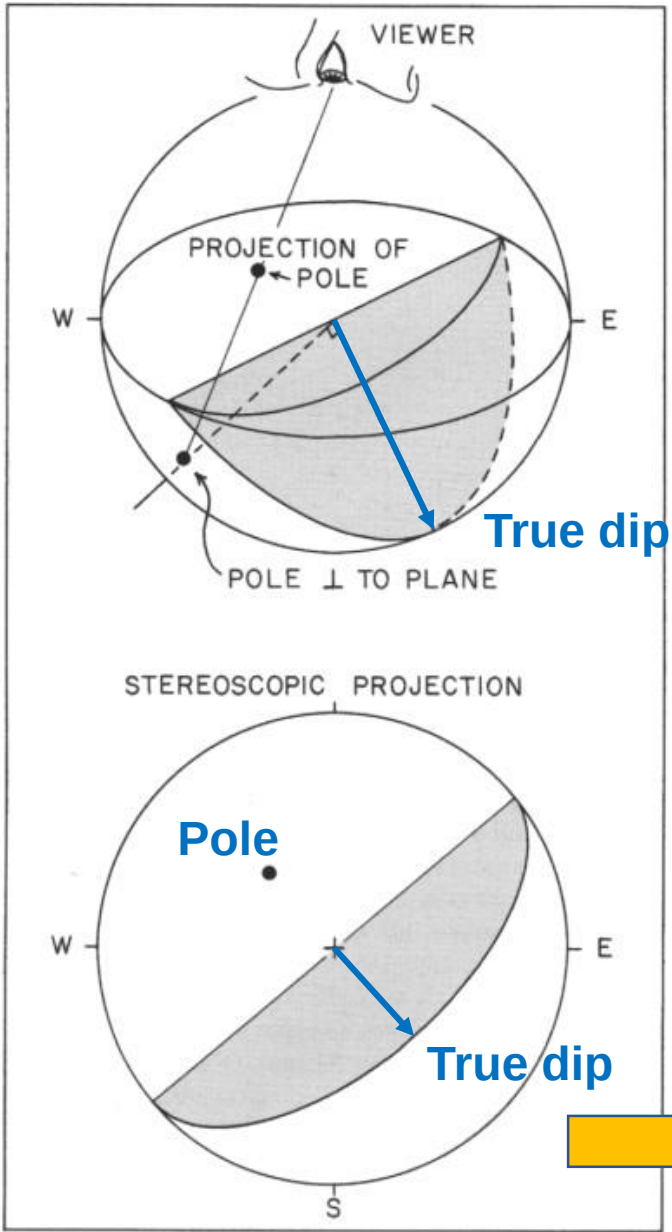
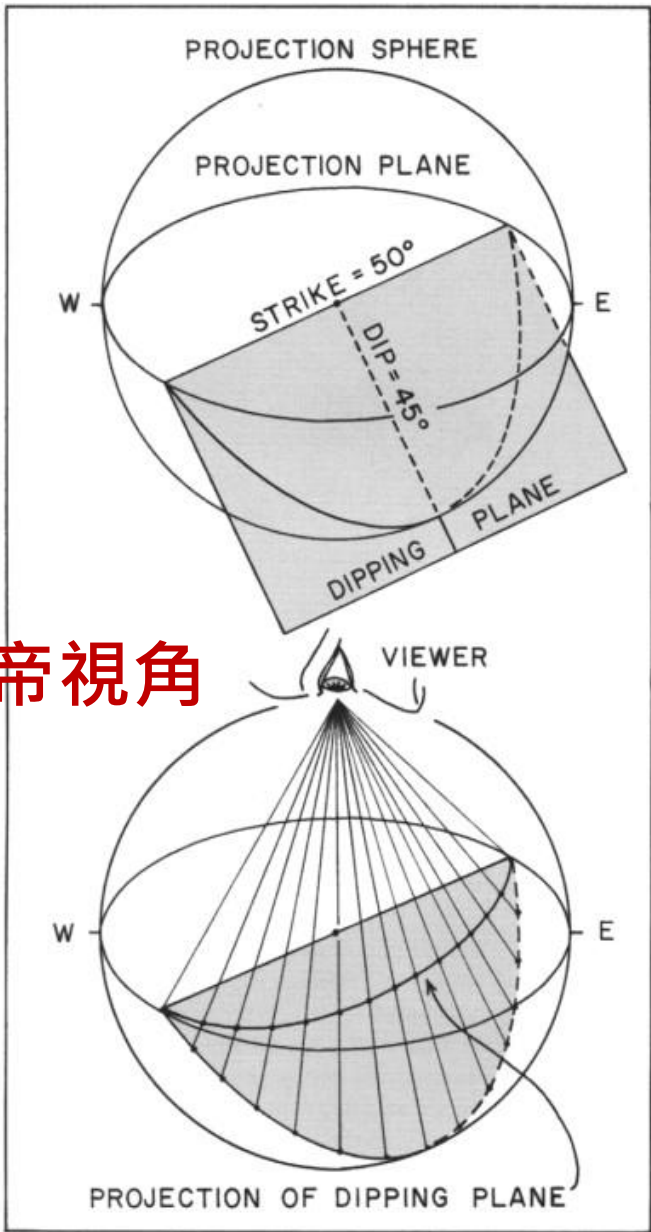
β is the angle between the strike and apparent dip direction.

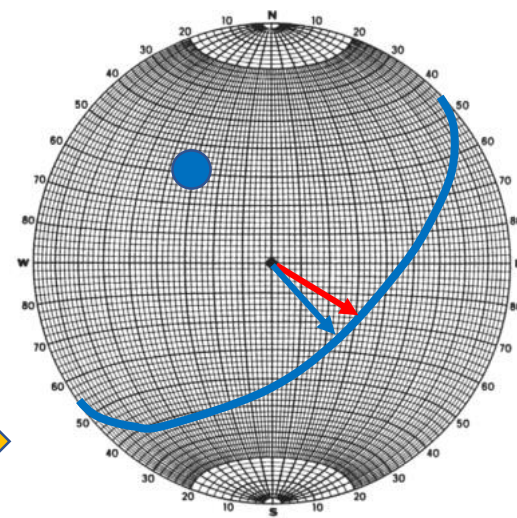
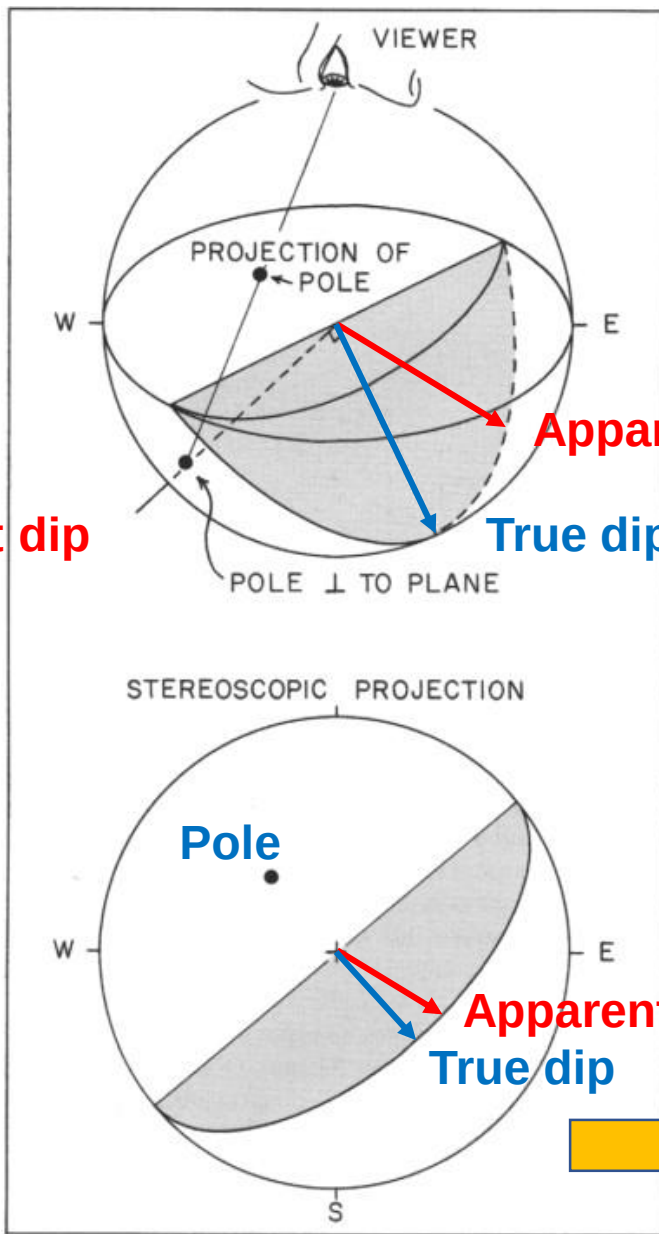
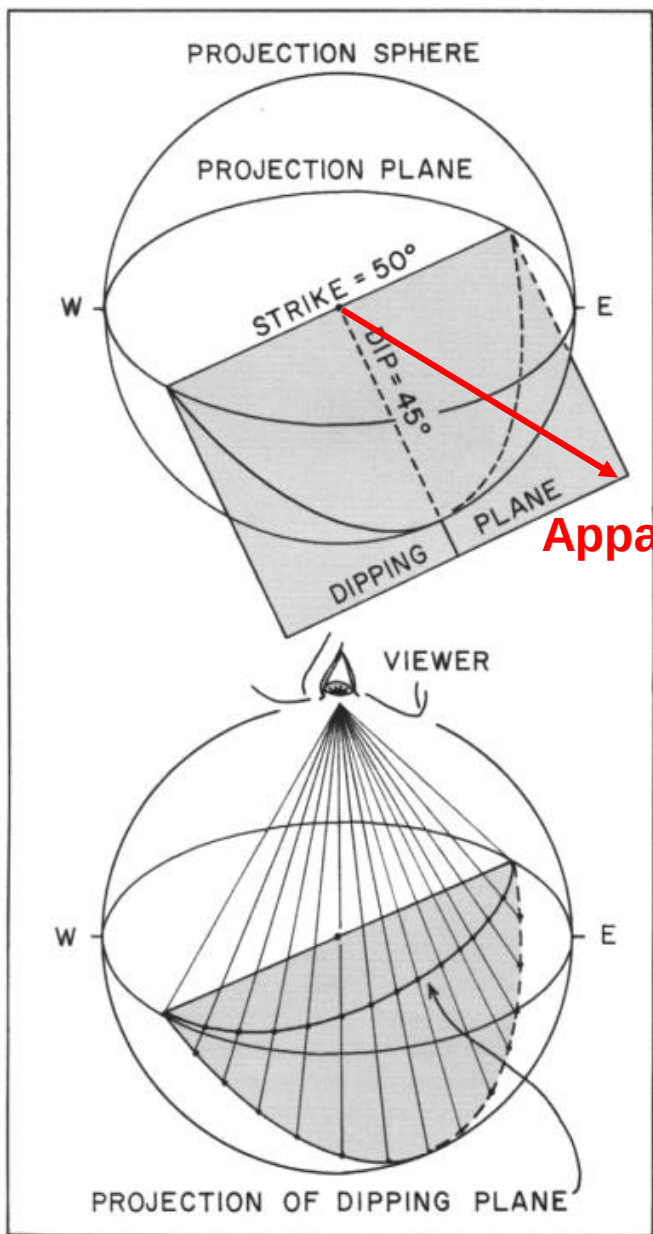
$$d = \overline{CO} \tan \delta = \overline{AO} \tan \alpha_1 = \frac{\overline{CO}}{\sin \beta} \tan \alpha_1$$

$$\tan \alpha_1 = \tan \delta \times \sin \beta$$



上帝視角



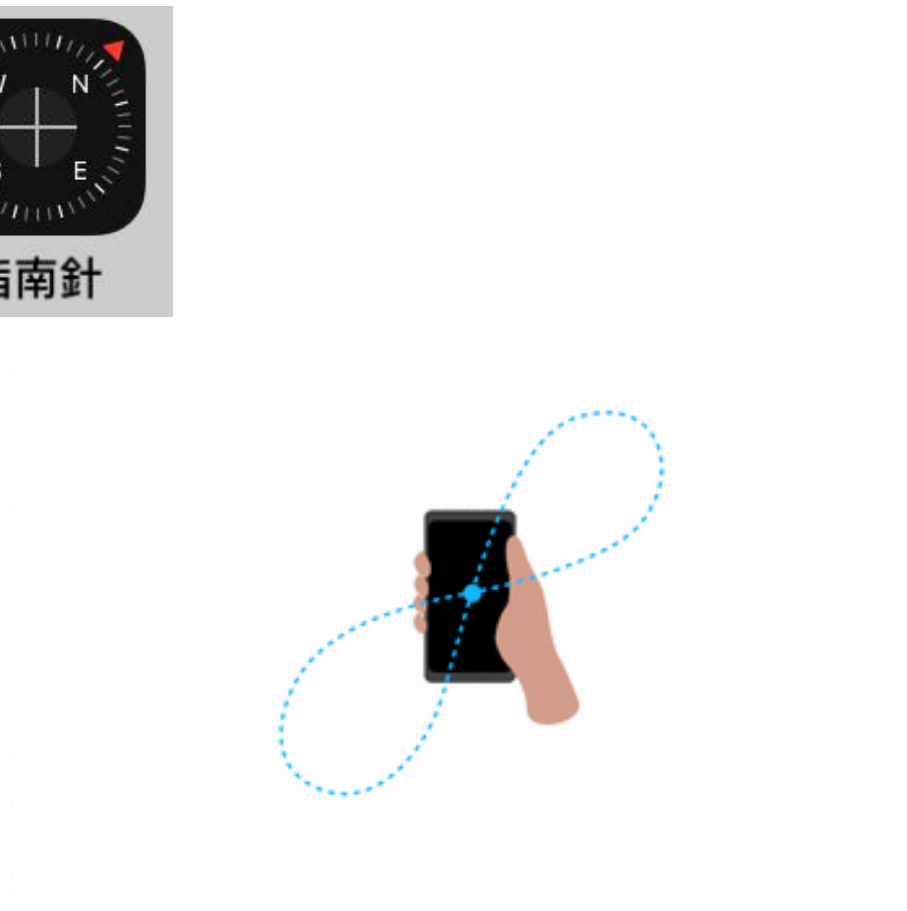
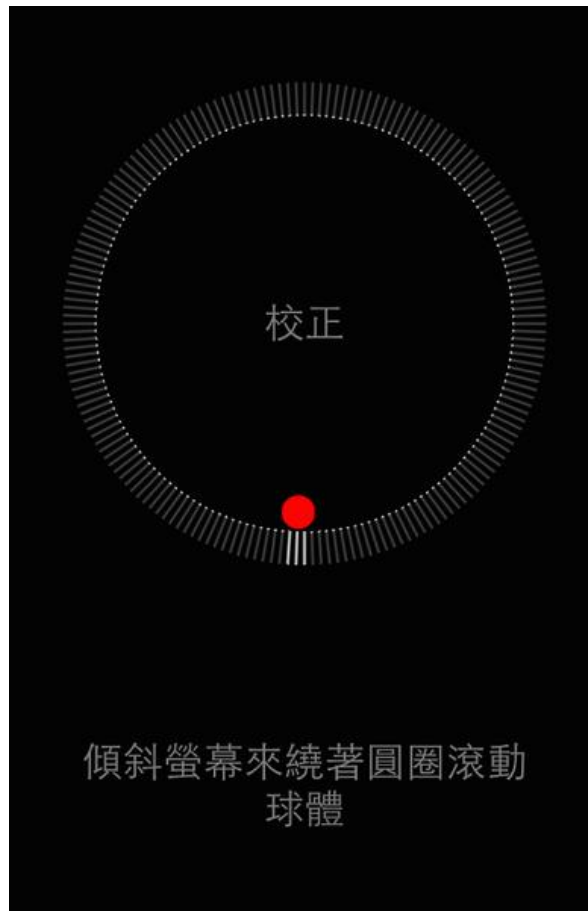


野外調查常備工具

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- ☐ 土壤硬度計



- ☐ 望遠鏡
- ☐ 比例尺
- ☐ 標準色卡
- ☐ 標本袋
- ☐ GPS定位儀
- ☐ 雷射測距儀
- ☐ 高度計
- ☐ 鹽酸





經濟部中央地質調查所
Central Geological Survey, MOEA

地質

資料整合查詢
National Geological Data Warehouse

知識網查詢 請輸入關鍵字

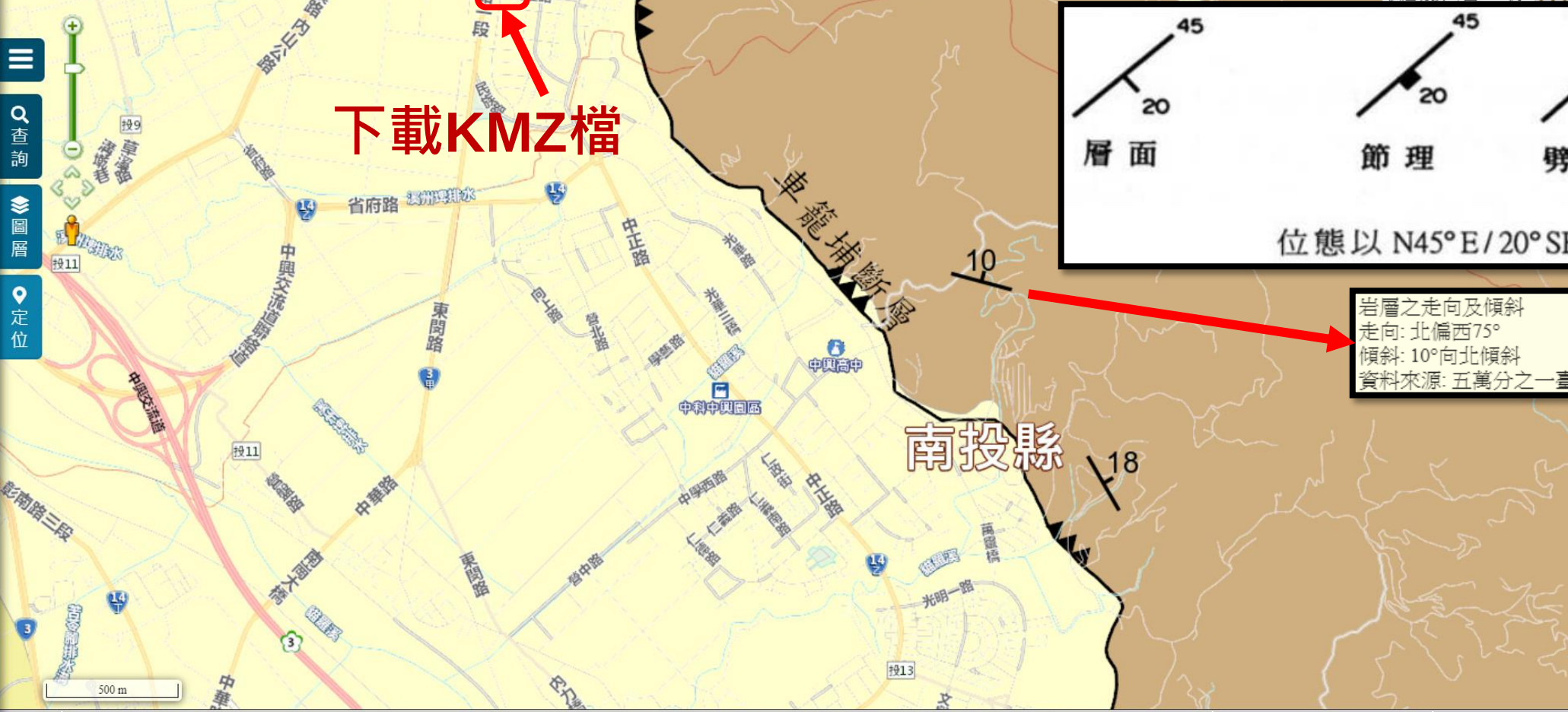
  系統首頁



查詢

圖層

定位



下載KMZ檔

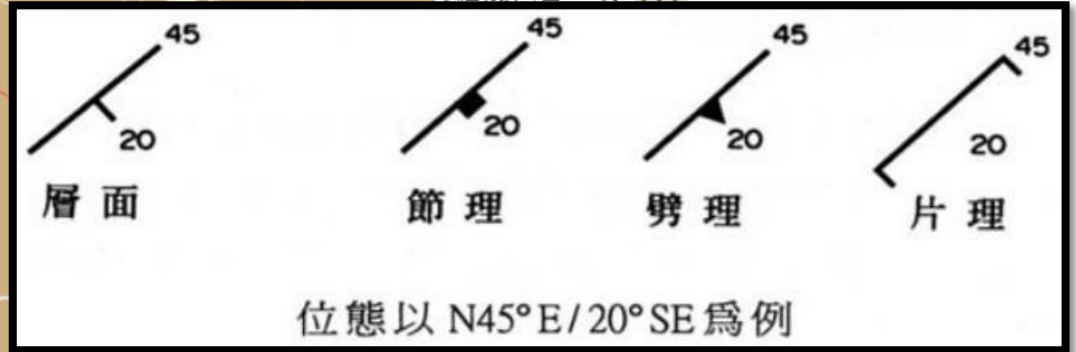
快速切換

圖例

選項 [WGS84經緯度]X:120.709233 Y:23.944959 (度)

(選擇比例尺) 約 1:20,000

Geo4ORACLE

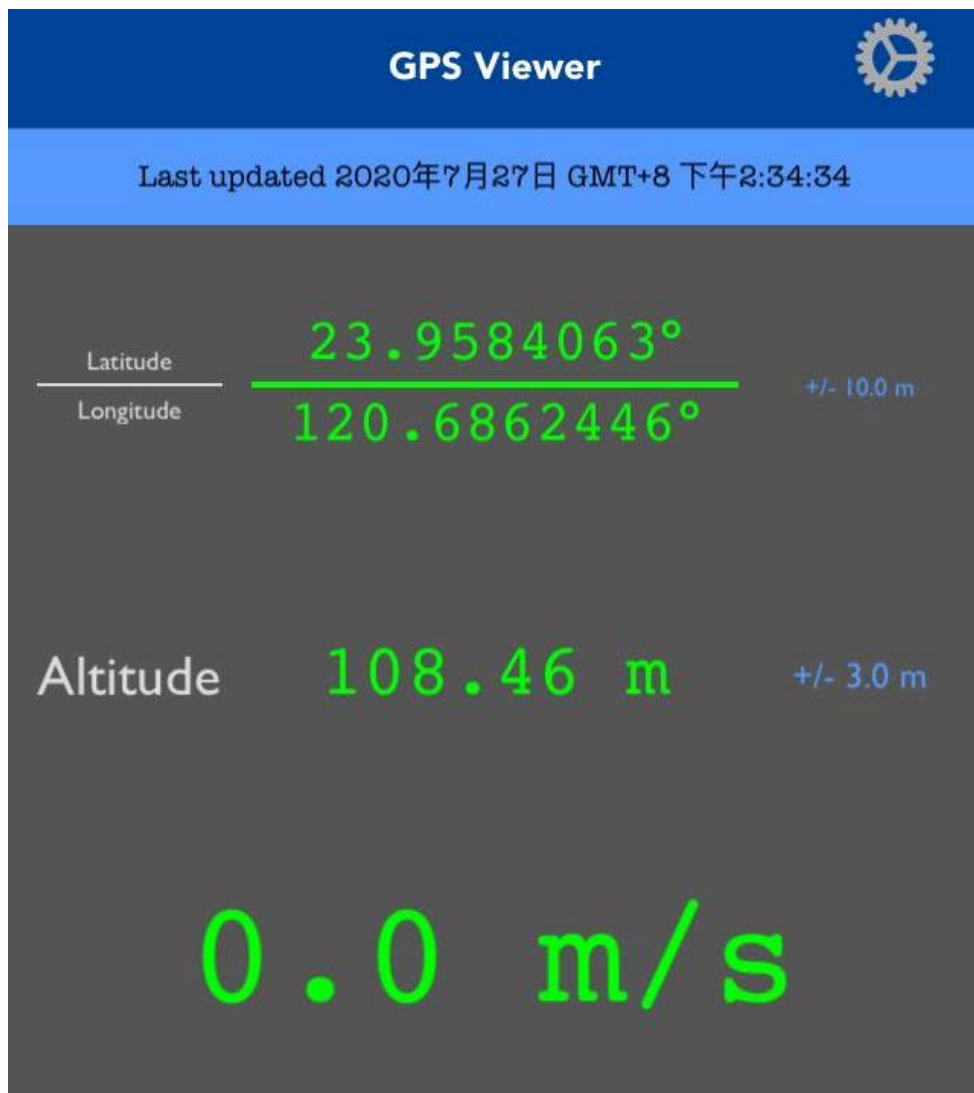


岩層之走向及傾斜
走向: 北偏西75°
傾斜: 10°向北傾斜
資料來源: 五萬分之一臺灣區域地質圖數值檔-南投,2010





GPS Status	Bad Fix	GPS Status	Poor Fix	GPS Status	Good Fix
Horizontal Accuracy	1414M	Horizontal Accuracy	200M	Horizontal Accuracy	30M
Vertical Accuracy	16M	Vertical Accuracy	12M	Vertical Accuracy	4M
Speed	Invalid	Speed	0MPH 0KPH	Speed	2MPH 4KPH
Course	Invalid	Course	Invalid	Course	207
Latitude	23.95774	Latitude	23.95823	Latitude	23.95841
Longitude	120.68604	Longitude	120.68625	Longitude	120.68611
Time	2020-07-27 06:25:08 +0000	Time	2020-07-27 06:26:10 +0000	Time	2020-07-27 06:25:14 +0000
Location		Location		Location	
Near:		Near:		Near:	
2 省府路,		2 省府路,		2 省府路,	
南投市,		南投市,		南投市,	
54045,		54045,		54045,	
台灣		台灣		台灣	







116 m

± 8 m

116 m $\div 0.3048 = 380.6$ ft

Map

Update

There are errors due to GPS
measurement.



Stereonet...

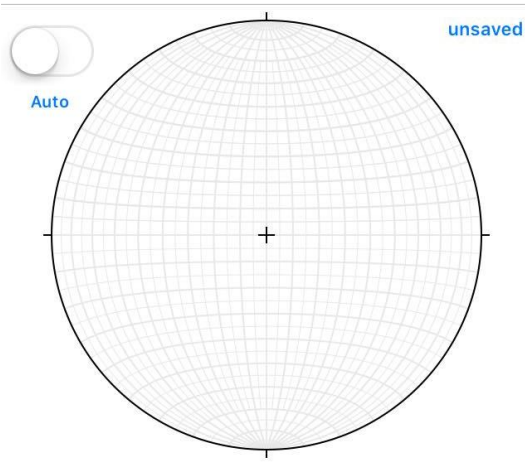


FaultKin M...



Clino

Plot Config Stereonet Data



Strike: Dip:

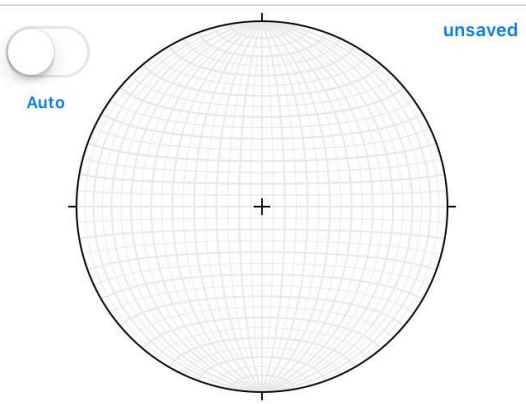
Lines Plan... Rake Bedding

GPS: ☐

Save



Configure FaultKin Data



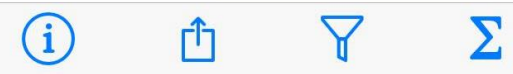
Normal

Strike: Dip:

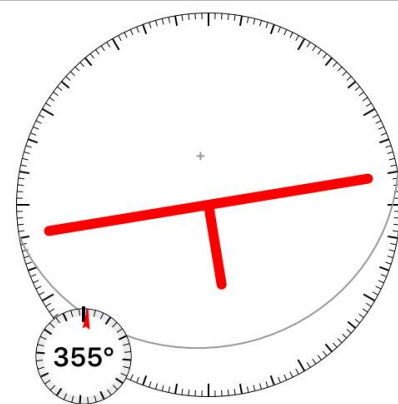
Rake: Aki Rk:

GPS: ☐

Location 1 Save



24° 07' 18" N 120° 40' 39" E
Updated 下午7:24



27 166

Tap to add a rock unit

Bedding

Comment

Locality 1

Save



Plot Config

Stereonet

Data

Auto

unsaved

Strike:

Dip:

Lines

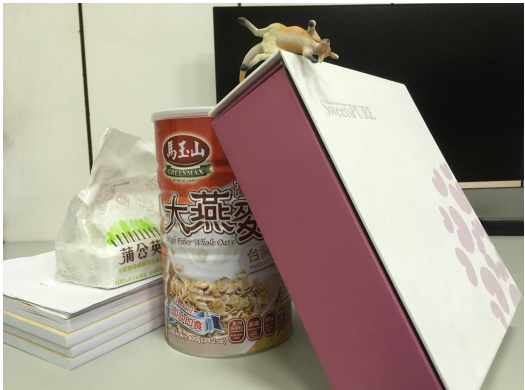
Plan...

Rake

Bedding

GPS:

Save



Plot Config

Stereonet

Data

Auto

unsaved

rike: **036.7 ± 0.06**

Dip: **60.0 ± 0.8**

Lines

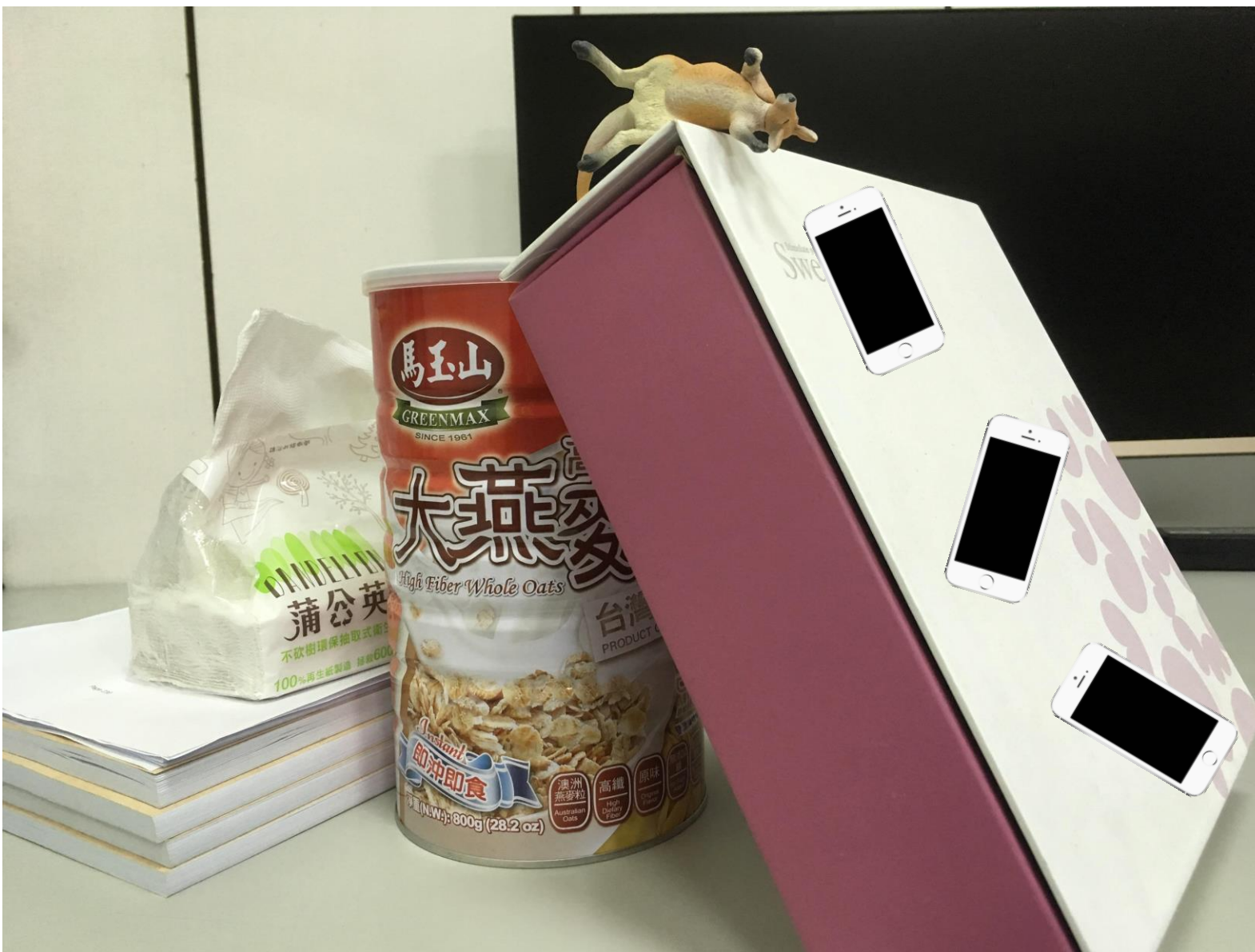
Plan...

Rake

Bedding

GPS: 120.6776269°, 024.1217951°; ± 65.0 m

Save

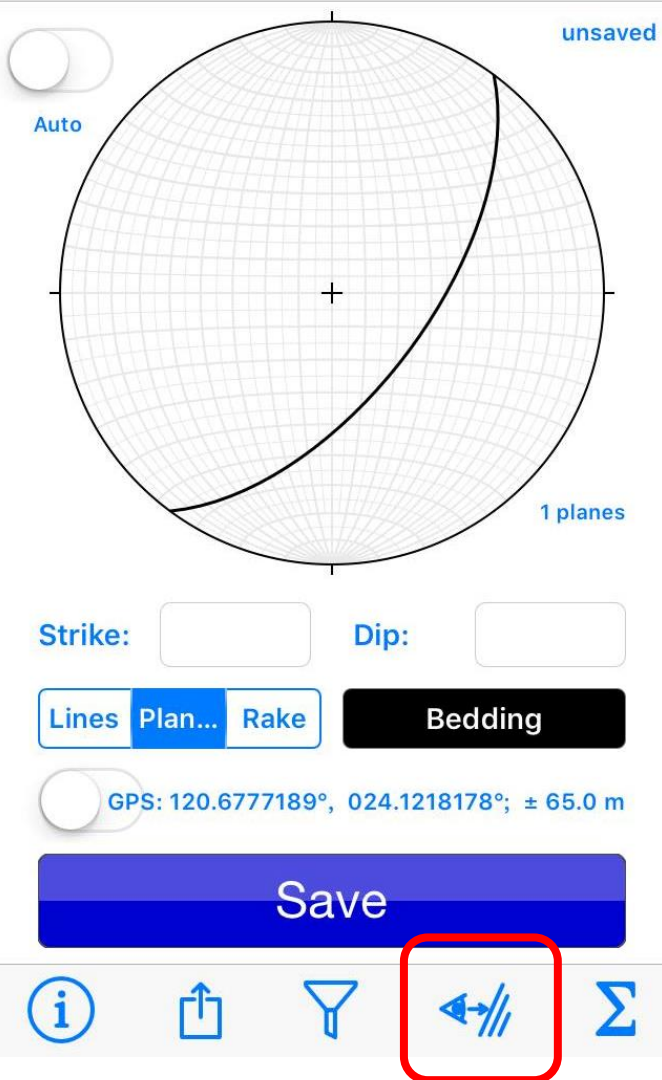




Plot Config

Stereonet

Data



< Stereonet

Sighting



Strike: 066.6 ± 0.41 58.1 ± 0.68

Strike // Down Dip

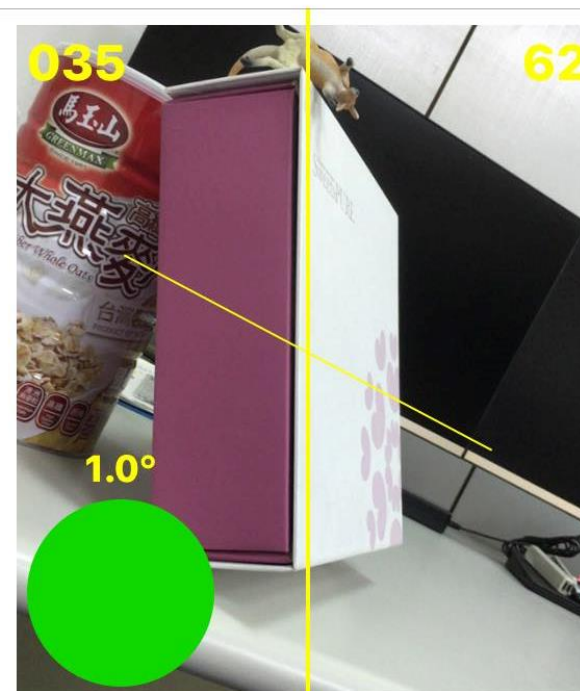
Bedding

GPS: 120.677747°, 024.1218698°; ± 150.9 m

Save

< Stereonet

Sighting



Strike: 035.2 ± 0.85 62.4 ± 0.55

Strike // Down Dip

Bedding

GPS: 120.6777514°, 024.1218723°; ± 65.0 m

Save



Plot Config

Stereonet

Data

Auto

1 planes

Strike:

Dip:

Lines

Plan...

Rake

Bedding

GPS: 120.6777189°, 024.1218178°; ± 65.0 m

Save

i

↑

↓

↔

Σ

Stereonet

Configure Plot

Projection:

Area

Angle

Polar

Planes as:

S & D

D & D Az

Poles

Plot:

Lines

Planes

Both

Contours:

☐

Kamb

1% area

Line type to

Cyl. Best Fit:

☐

All

by Type

Mean Vector:

☐

All

by Type

Rose Diagram:

☐

Symme...

Asymm...

i

Σ

Plot Config

Calculations

ROTATE DATA

Azimuth

Plunge

Magnitude

Lines

Planes

Both

POLES & PLANES

Poles from planes

Planes from poles

A new data type will be created and appended to the appropriate lines or planes data set

ANGLE BETWEEN

2 Lines

2 Planes

Tap and drag the two lines, or two planes,

Plot Config

Stereonet

Data

Auto

1 lines

1 planes

Strike:

Dip:

Lines

Plan...

Rake

Bedding

GPS:

Save

i

↑

↓

↔

Σ

Stereonet Configure Plot

Projection:

Area

Angle

Polar

Planes as:

S & D

D & D Az

Poles

Plot:

Lines

Planes

Both

Contours:

☐

Kamb

1% area

Line type to

Cyl. Best Fit:

☐

All

by Type

Mean Vector:

☐

All

by Type

Rose Diagram:

☐

Symme...

Asymm...

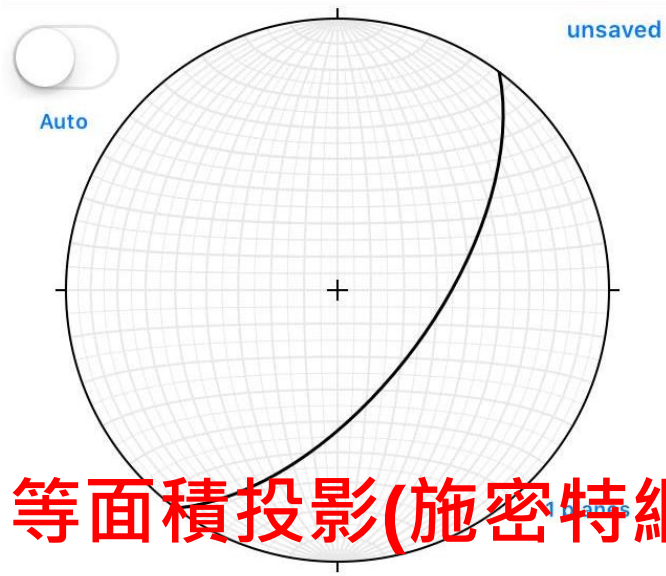
i

Σ

Plot Config

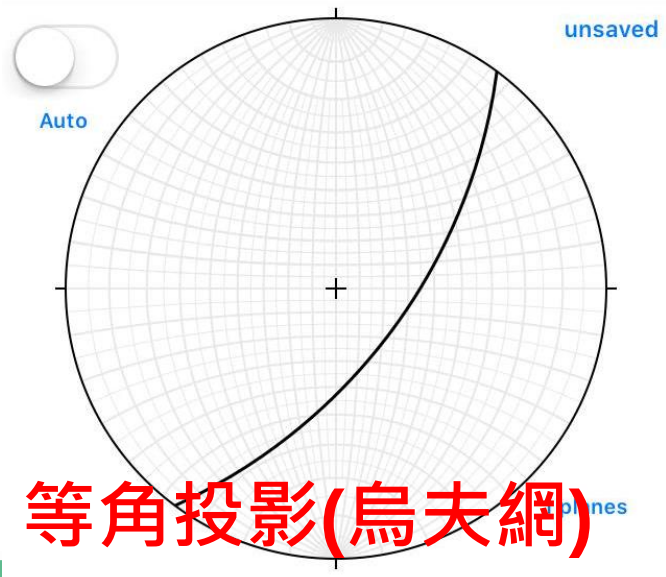
Stereonet

Data



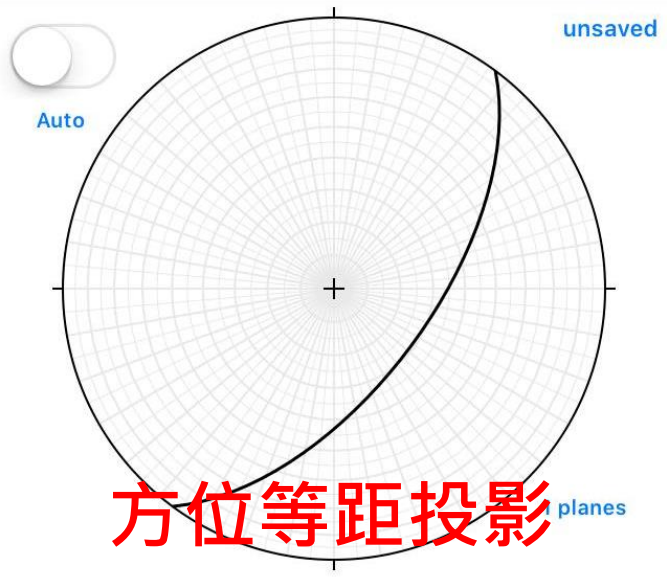
等面積投影(施密特網)

Plot Config Stereonet Data



等角投影(烏夫網)

Plot Config Stereonet Data



方位等距投影

< Stereonet Configure Plot

Projection: **Area** Angle Polar

Planes as: **S & D** D & D Az Poles

Plot: Plot Config **Stereonet**

Contours: ☐

Line type
to Auto

Cyl. Best

Mean Vec

Rose Diag

描述面的方位

Strike: Dip:

Lines Plan... Rake **Bedding**

GPS: 120.6777189°, 024.1218178°; ± 65.0 m

Save

< Stereonet Configure Plot

Projection: **Area** Angle Polar

Planes as: S & D **D & D Az** Poles

Data ot: Plot Config **Stereonet**

Contours: ☐

Line type
to Auto

l. Best Fit:

ean Vector

se Diagram

描述面或線的方位

Dip Az: Dip:

Lines Plan... Rake **Bedding**

GPS: 120.6777028°, 024.1218063°; ± 315.3 m

Save

< Stereonet Configure Plot

Projection: **Area** Angle Polar

Planes as: S & D D & D Az **Poles**

Data Plot Config **Stereonet**

Contours: ☐

type
to Auto

est Fit:

Vector

Diagram

描述線的方位

Trend: Plunge:

Lines Plan... Rake **Bedding**

GPS: 120.6777028°, 024.1218063°; ± 315.3 m

Save

< Stereonet Configure Plot

Projection:

Planes as:

Plot:

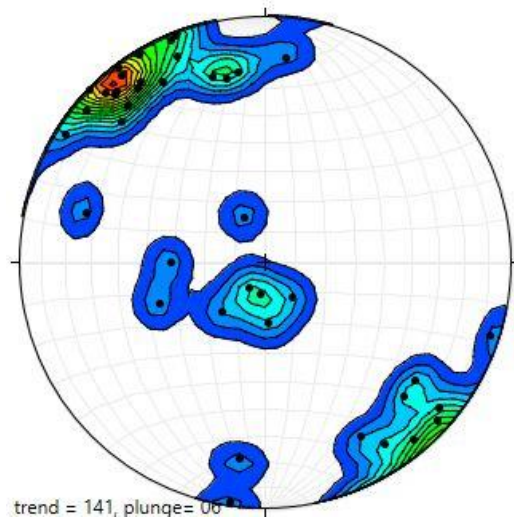
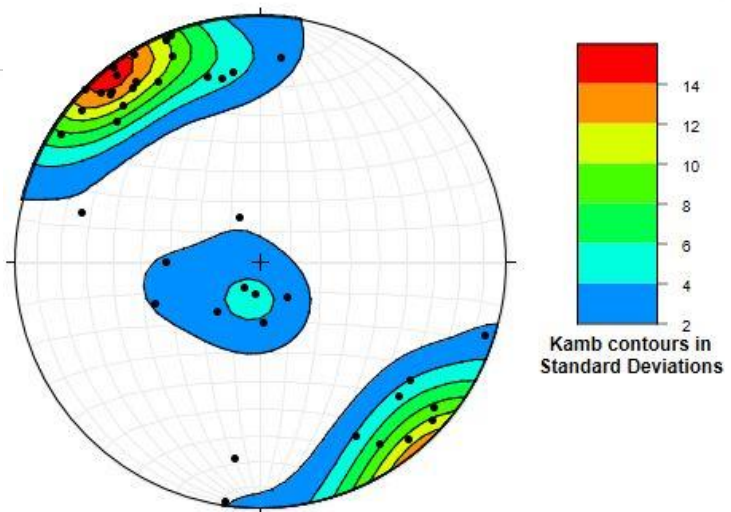
Contours: ☐

Line type to

Cyl. Best Fit: ☐

Mean Vector: ☐

Rose Diagram: ☐



trend = 141, plunge = 06

< Stereonet Configure Plot

Projection:

Planes as:

Plot:

Contours: ☐

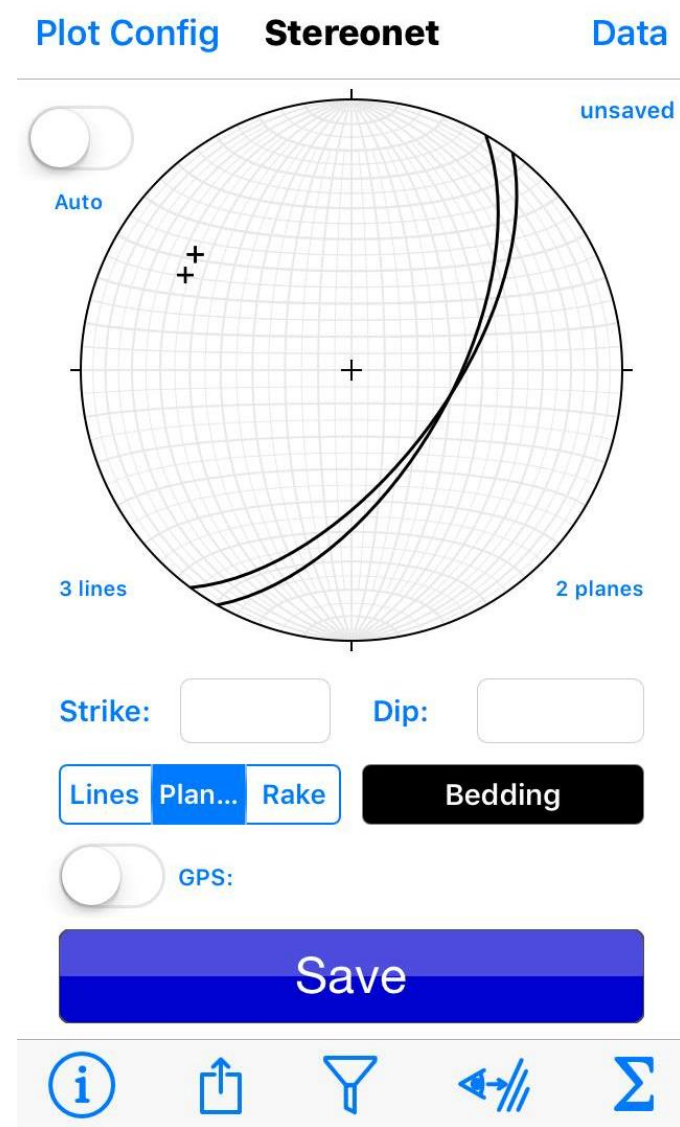
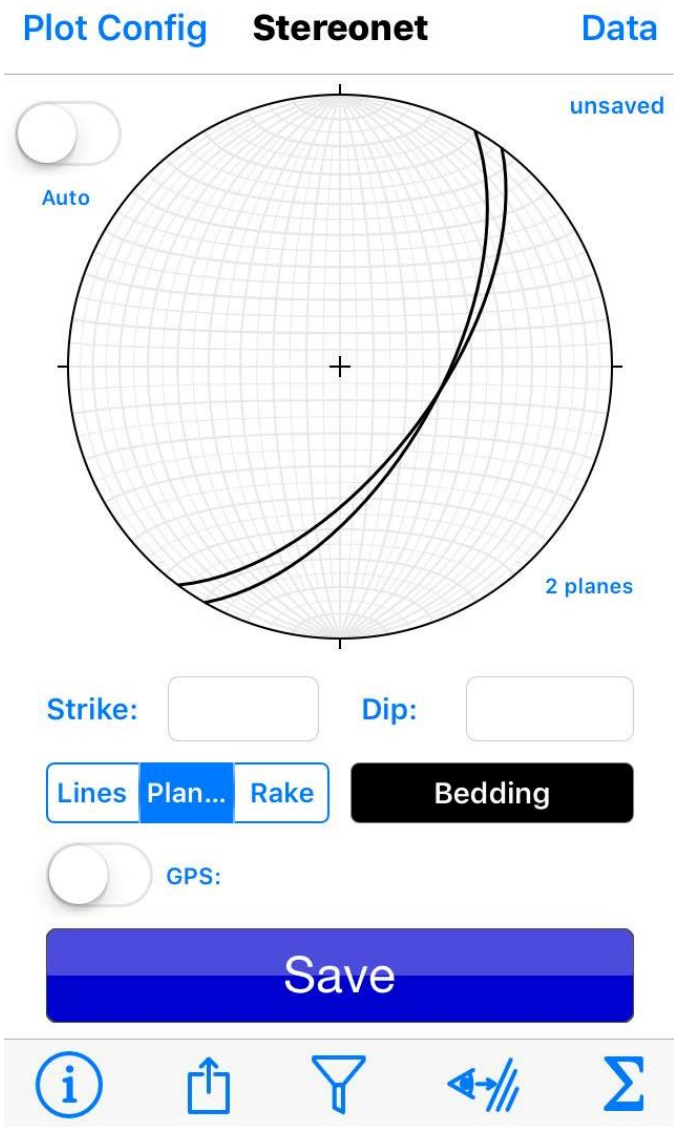
Line type to

Cyl. Best Fit: ☐

Mean Vector: ☐

Rose Diagram: ☐





Stereonet Configure Plot

Plot Config

Stereonet

Data

Projection: **Area** Angle Polar

Planes as: **S & D** D & D Az Poles

Plot: Lines Planes **Both**

Contours: ☐ **Kamb** 1% area

Line type
to

Bedding poles (2)

Cyl. Best Fit: ☐ All **by Type**

Mean Vector: ☒ All **by Type**

Rose Diagram: ☐ **Symme...** Asymm...

平均向量

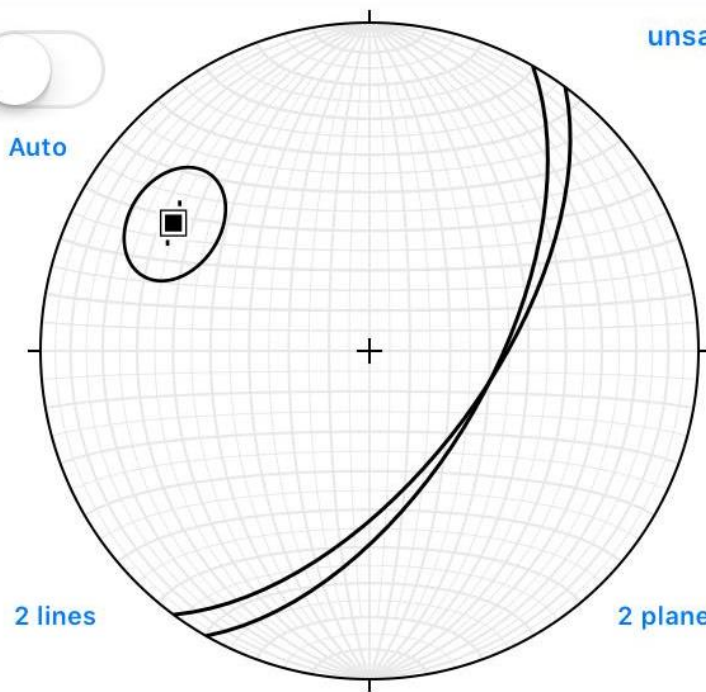
----- Fisher Mean Vector | 2020-07-27 20:12:41-----

for Data type Bedding poles

	N	Trd	Plg	a95	a99	kappa
mean len						
all	2	303.2	29.5	13.0	30.0	368.9
		0.9986				
N < 16; Kappa (Fisher et al. 1987) = 184.4						



Auto



unsaved

Strike:

Dip:

Lines **Plan...** Rake

Bedding

GPS: 120.6777028°, 024.1218063°; ± 315.3 m

Save



Stereonet Configure Plot

Projection: **Area** Angle Polar

Planes as: **S & D** D & D Az Poles

Plot: **Lines** Planes **Both**

Contours: ☐ **Kamb** 1% area

Line type
to

Bedding poles (2)

圓柱最佳擬合

Cyl. Best Fit: ☒ **All** by Type

Mean Vector: ☐ **All** by Type

Rose Diagram: ☐ **Symme...** Asymm...

for Data type Bedding poles

Axis	Eigenval	Trend	Plunge	a95 min
a95 max				
1.	0.9973	303.2;	29.5	N/A
N/A				
2.	0.0027	208.4;	08.4	
3.	-0.0000	104.1;	59.1	N/
A N/A				
Best fit great circle (strike, dip RHR) = 194.1; 30.9				

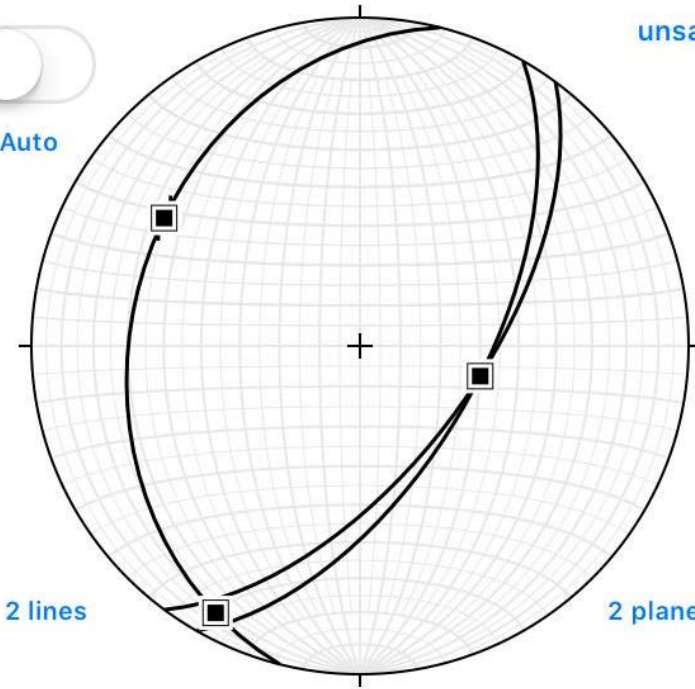
Plot Config

Stereonet

Data



Auto



2 lines

2 planes

Strike:

Dip:

Lines Plan... Rake

Bedding

GPS: 120.6777028°, 024.1218063°; ± 315.3 m

Save



Stereonet Configure Plot

Plot Config

Stereonet

Data

Projection:

Planes as:

Plot:

Contours: ☐

Line type to **Bedding poles (2)**

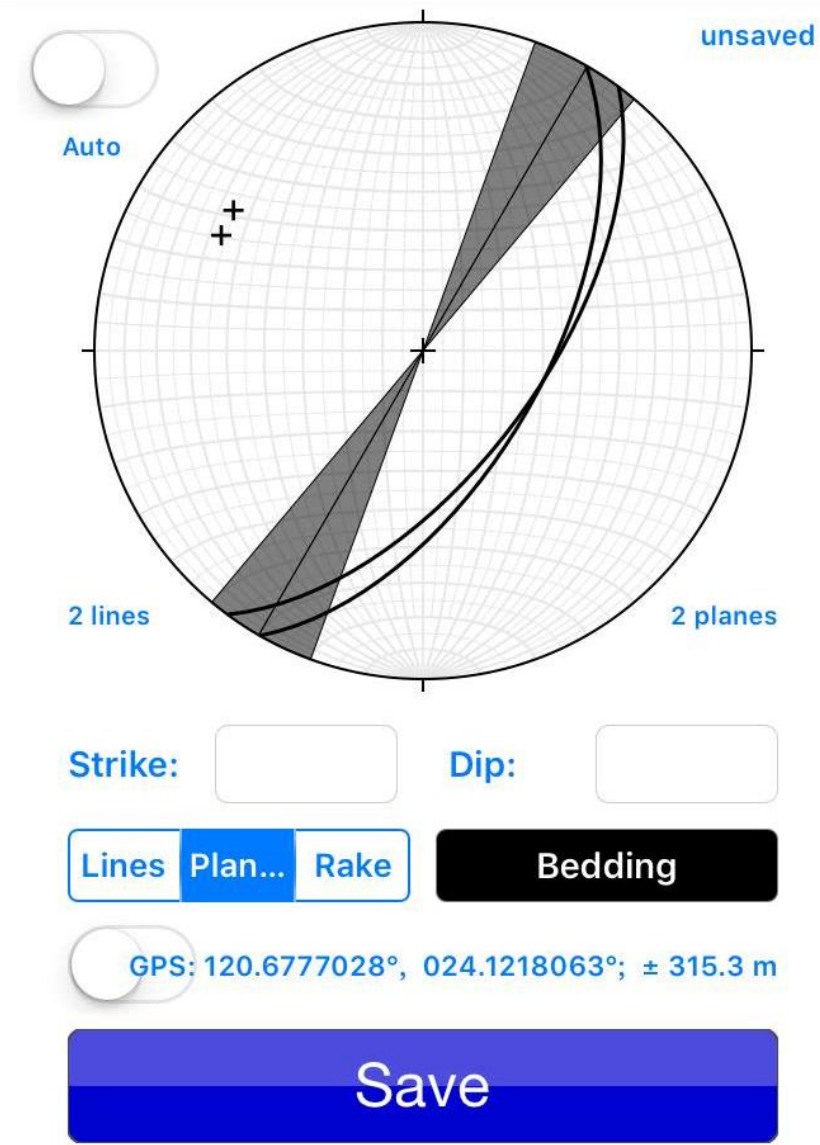
Cyl. Best Fit: ☐

Mean Vector: ☐

玫瑰圖 Rose Diagram: ☒

----- Rose diagram/Circular Histogram | 2020-07-27 20:12:45-----

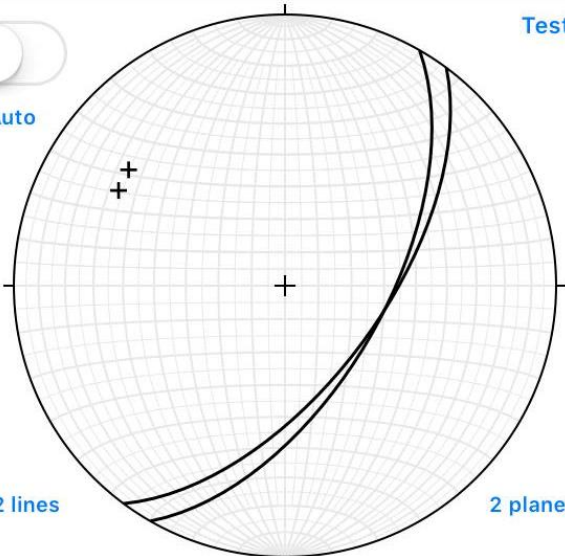
From planes data set (petals parallel strike direction); data type = Bedding
Bin size = 10; petals scaled by area
Max value = 050.0% between 021° and 030°
Mean Vec = 033.2° ± 05.7°; Average Length = 0.993
Circular Variance = 0.007; kappa = 50.242



Plot Config Stereonet

Data

☐ Auto



2 lines 2 planes

Strike: Dip:

Lines Plan... Rake

Bedding

☐ GPS:

Save



< Stereonet Data

Name:

Go to: /2

Lines Planes

Planes (Strike; Dip)

1. 036.5; 61.0

Long = 120.67774; lat = 24.12184; 20...





2. 029.8; 60.0

Long = 120.67771; lat = 24.12191; 20...





Save Open



< Stereonet Data

Name:

Go to: /2

Lines Planes

Lines (Trend; Plunge)

1. 306.5; 29.0

Long = 120.67774; lat = 24.12184; 20...





2. 299.8; 30.0

Long = 120.67771; lat = 24.12191; 20...





Save Open





< Stereonet

Data

Name: Test.txt

Go to:

1

/2

Lines

Planes

Planes (Strike; Dip)

1. 036.5; 61.0

Long = 120.67774; lat = 24.12184; 20...



2. 029.8; 60.0

Long = 120.67771; lat = 24.12191; 20...



Save

Open



These files are available on the device.
Tap one to open from the list, below

Clipboard

tap for Clipboard text

only text in the same format as s...

Files

RecoveryFile.txt

modified 2020-07-28 01:27:53

Test.txt

modified 2020-07-28 01:30:04



Delete File

Cancel

< Stereonet

Data

Name:

Test.txt

Go to:

1

/2

Lines

Planes

Planes (Strike; Dip)

1. 036.5; 61.0

Long = 120.67774; lat = 24.12184; 20...

2. 029.8; 60.0

Long = 120.67771; lat = 24.12191; 20...

Save

Open

< Stereonet

Data

Name:

Test.txt

Go to:

1

/2

Lines

Planes

Lines (Trend; Plunge)

1. 306.5; 29.0

Long = 120.67774; lat = 24.12184; 20...

2. 299.8; 30.0

Long = 120.67771; lat = 24.12191; 20...

display

Save

Open

< Data List

Map View



GPS:

Satellite

Road

< Stereonet Data

Name: Test.txt

Go to: 1 /2 Lines Planes

Planes (Strike; Dip)

1. 036.5; 61.0

Long = 120.67774; lat = 24.12184; 20...

2. 029.8; 60.0

Long = 120.67771; lat = 24.12191; 20...

Save

Open



< Stereonet Data

Name: Test.txt

Go to: 1 /2 Lines Planes

Lines (Trend; Plunge)

1. 306.5; 29.0

Long = 120.67774; lat = 24.12184; 20...

2. 299.8; 30.0

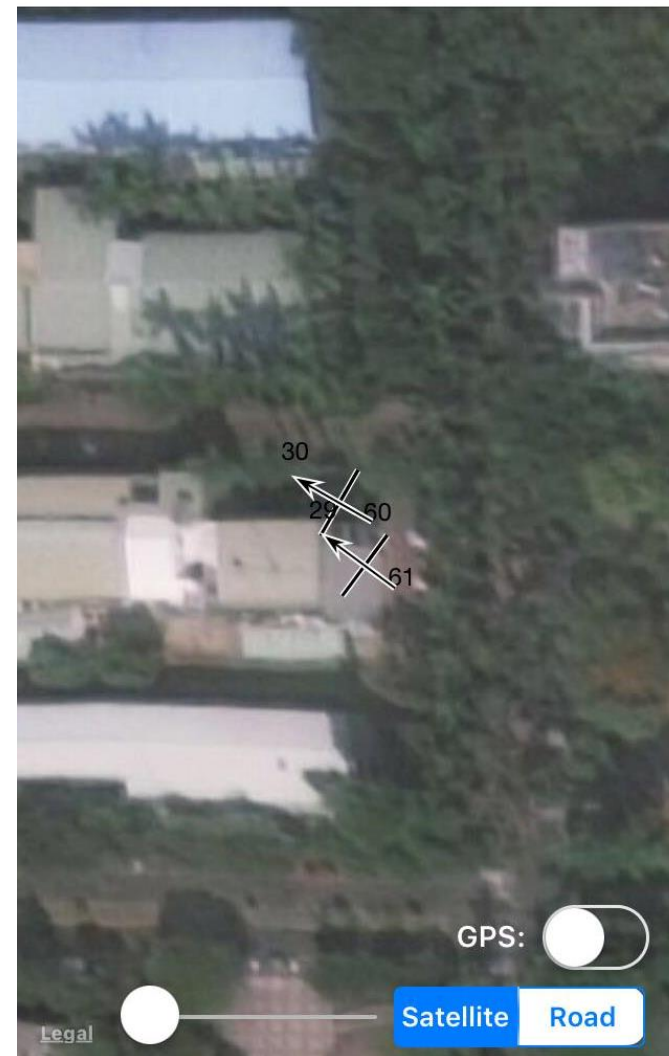
Long = 120.67771; lat = 24.12191; 20...

Save

Open



< Data List Map View





報告完畢 敬請指教



行政院農業委員會水土保持局
與您一起打拼