



Le Pieghe

Da Ramsay and Huber, 1987

Immagini e fotografie tratte da:

- Boccaletti M & Tortorici L., 1987. *Appunti di Geologia Strutturale*. Patron Editore.
- Champati, A.K., et al., 2017. Hook-shaped type-3 superposed fold in granulite, Badarama complex, Rengali province, India. *International Journal of Earth Sciences*, 106, 2473–2474. <https://doi.org/10.1007/s00531-017-1486-5>
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GA Pini



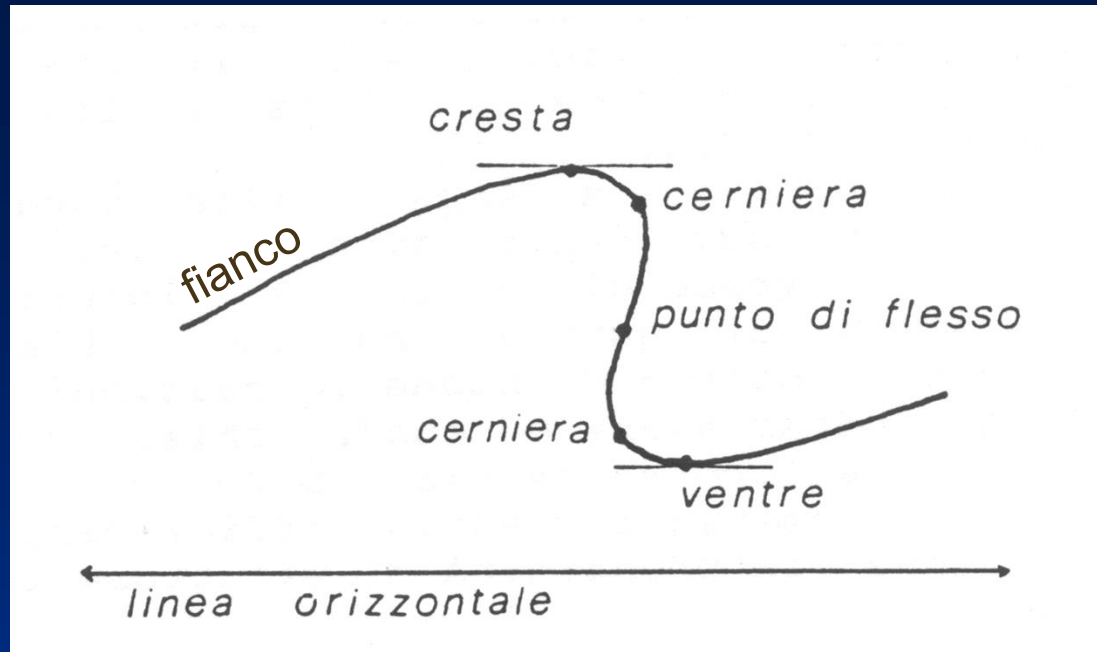
GA Pini



Da Ramsay and Huber, 1987

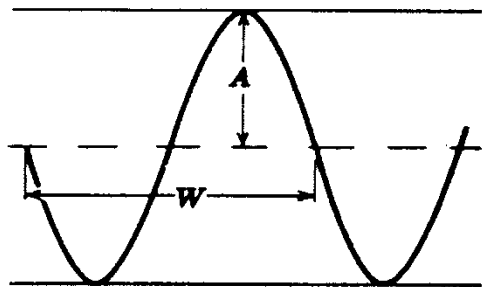
Da Ramsay and Huber, 1987



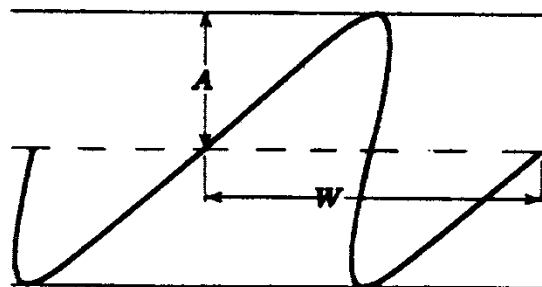


Da Boccaletti & Tortorici, 1987

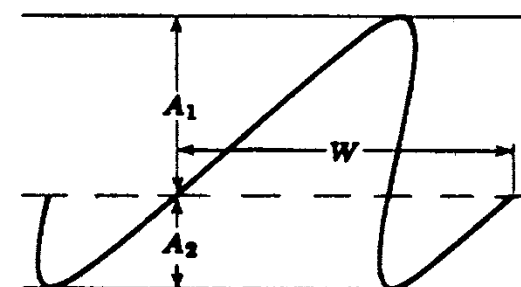
W =lunghezza d'onda; A =ampiezza



a
Piega simmetrica



b
Piega asimmetrica



c

Da Boccaletti & Tortorici, 1987

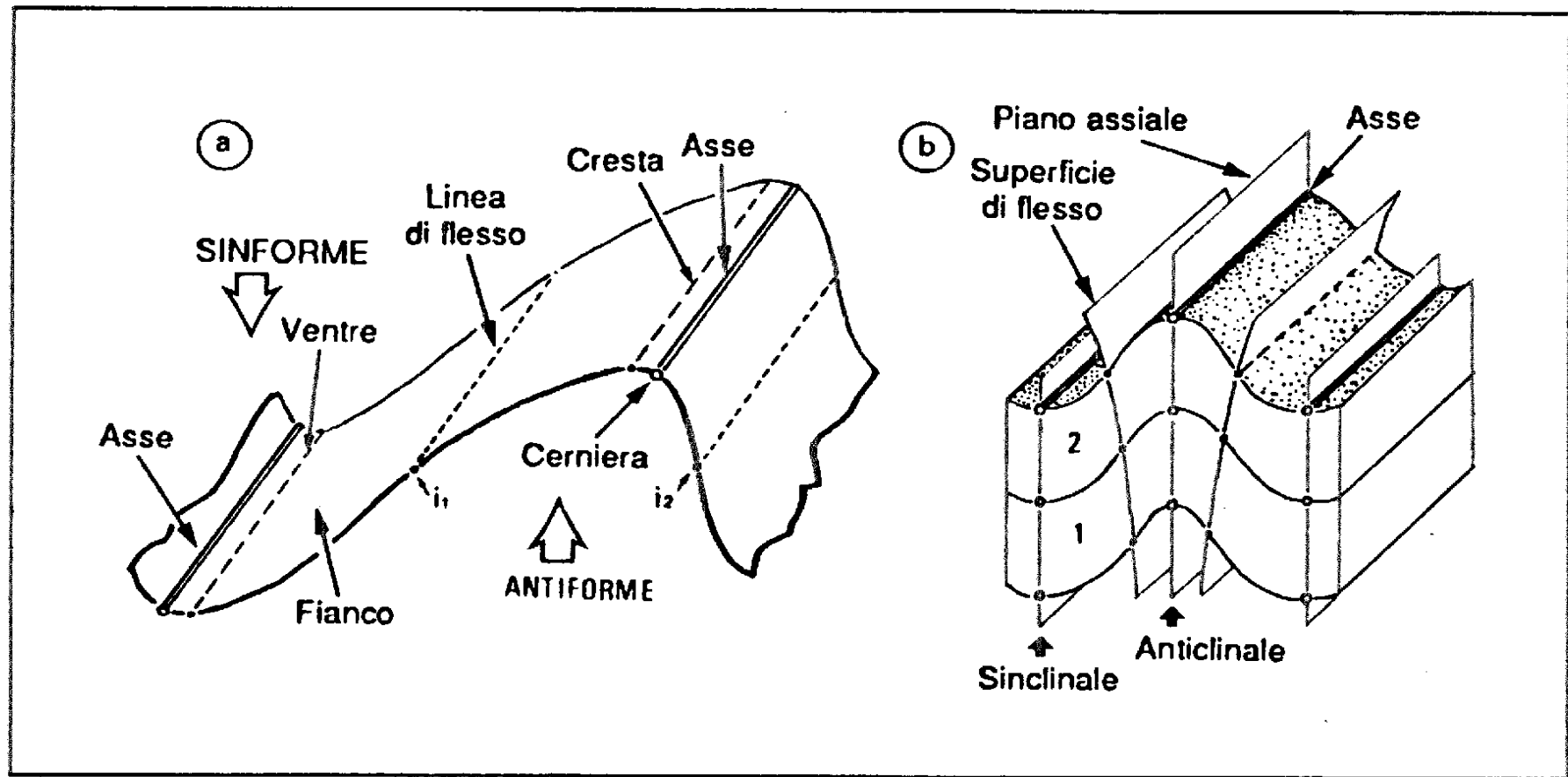
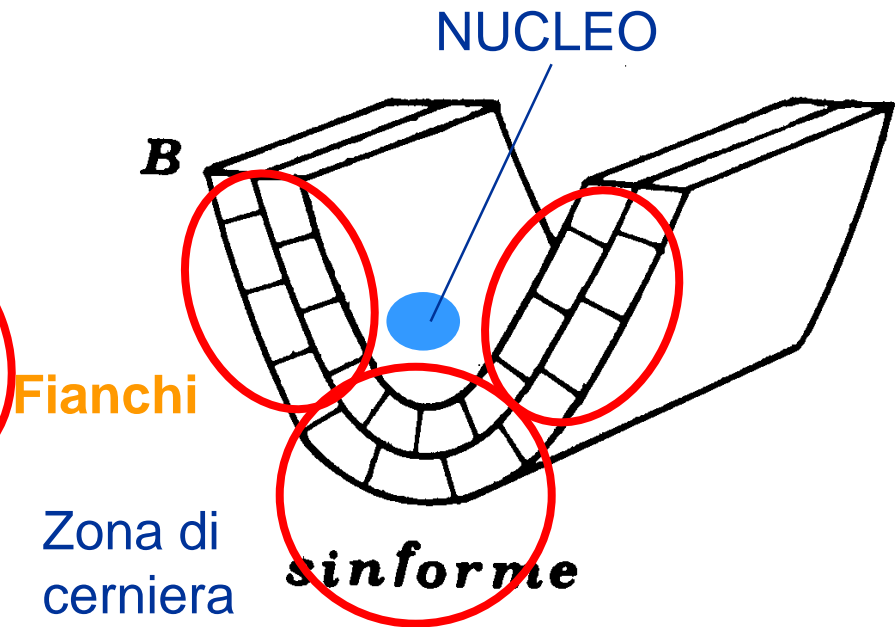
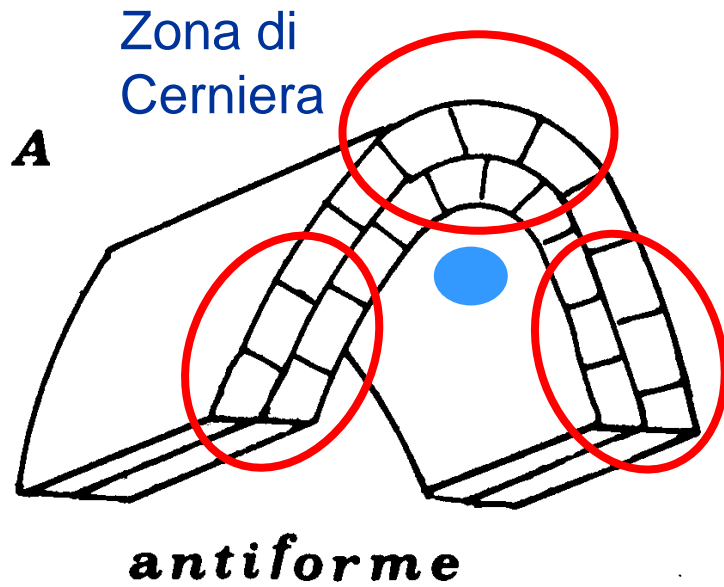


Figura 8.1. Principali termini utilizzati per la descrizione delle pieghe.





Anticlinale=rocce più antiche al nucleo
Sinclinale=rocce più recenti al nucleo

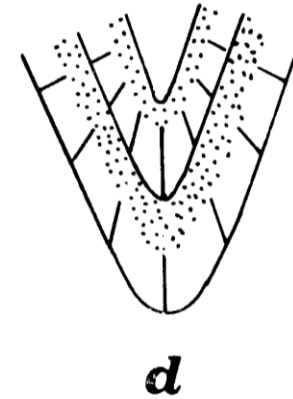
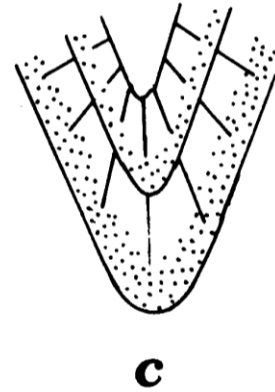
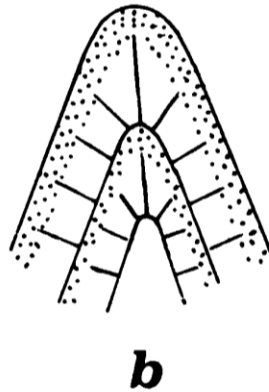
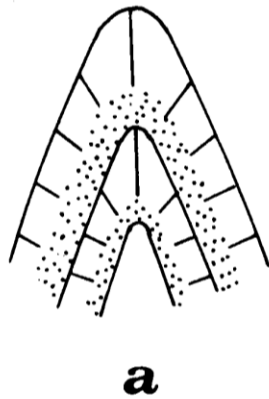
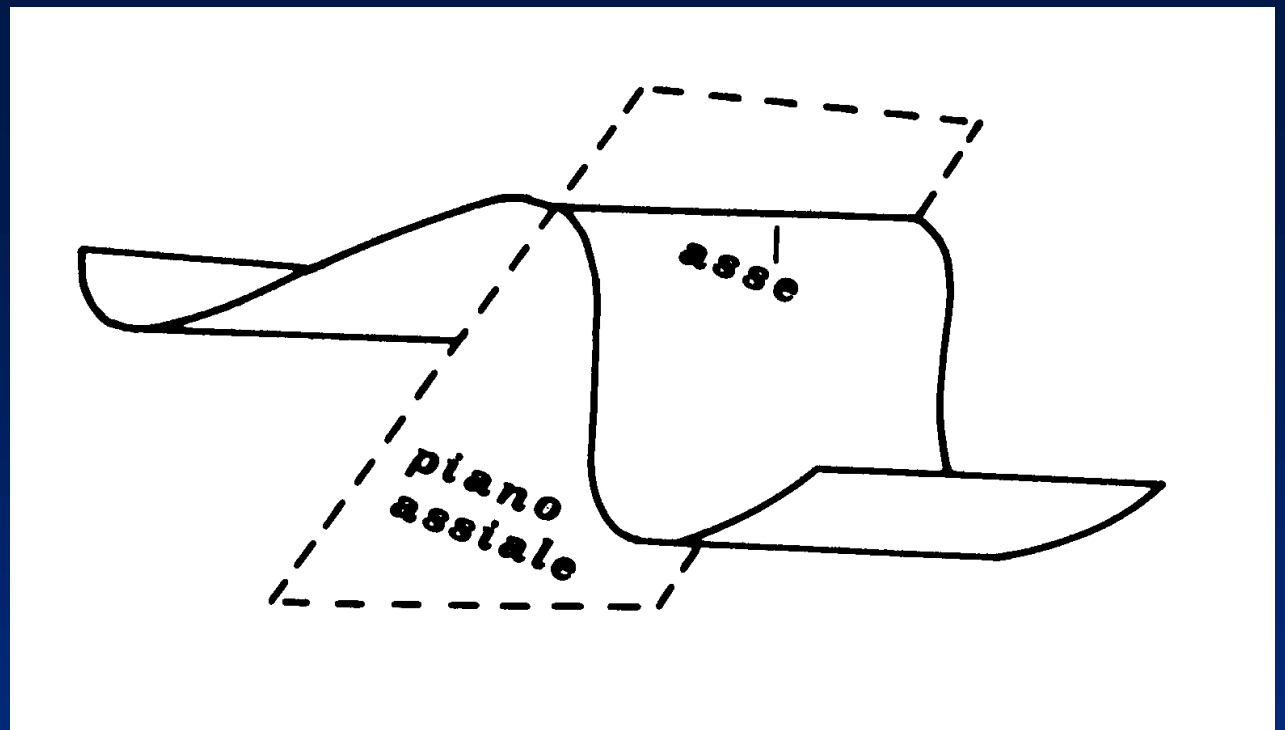


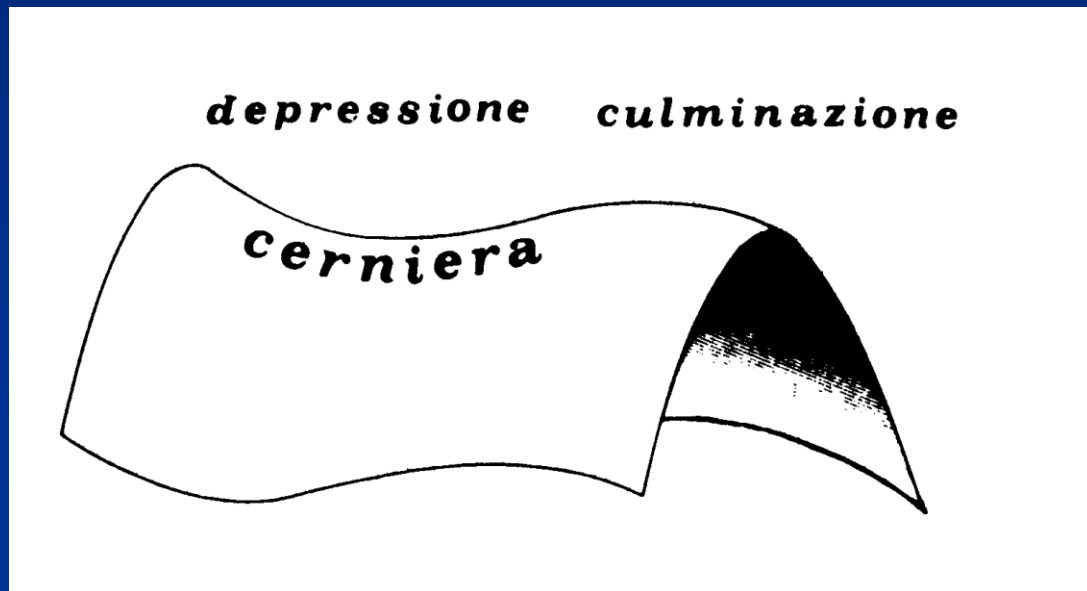
Fig. 50 - Esempi di antiforme anticlinale (a), antiforme sinclinale (b), sinforme sinclinale (c) e sinforme anticlinale (d).

Da Boccaletti & Tortorici, 1987



Da Boccaletti & Tortorici, 1987

Da Boccaletti & Tortorici, 1987





Esempio di culminazioni e depressioni



Makran - Iran

Esempio di “chiusura” periclinale





Khormocj

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Data di acquisizione delle immagini: 14 Set 2006

28°36'49.35" N 51°43'13.76" E 1158 m elev

8.15 km Alt

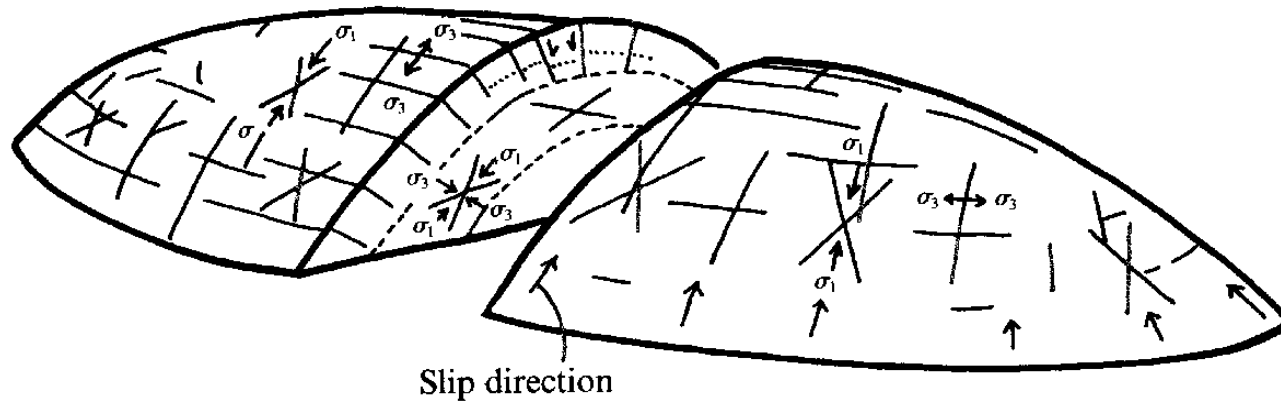
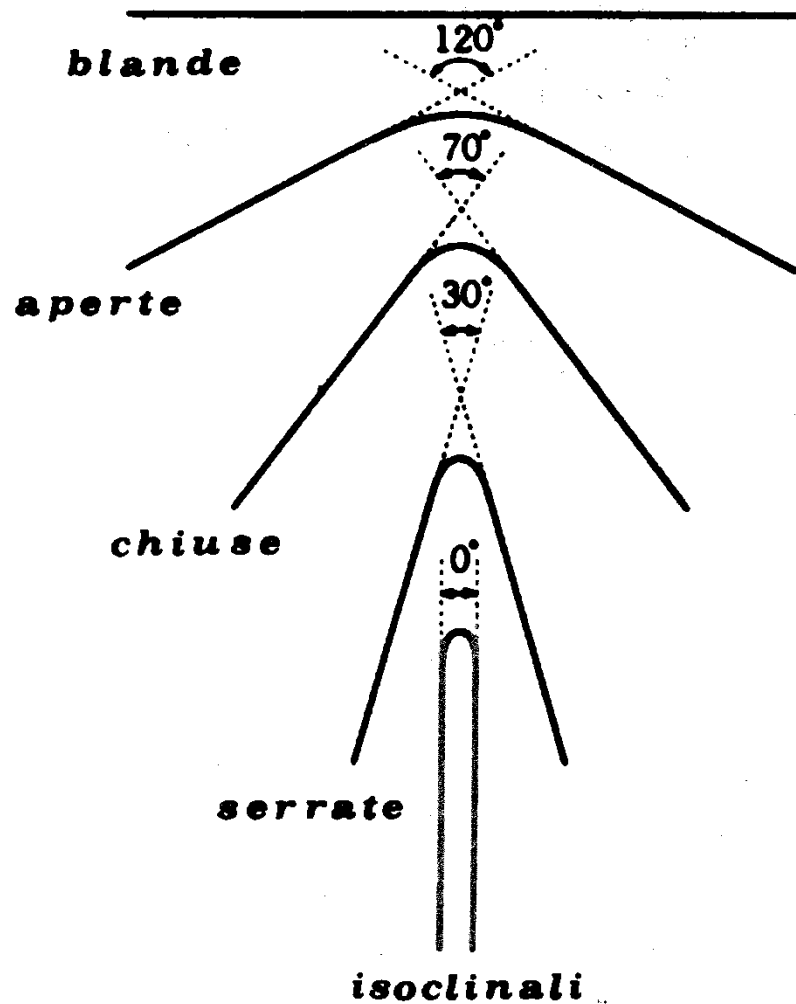


Fig. 14.24. Variations in orientation of fracture patterns in a dome. Inferred slip direction in the dome is indicated. (After Stearns 1964, and other sources.)

Da Price and Cosgrove, 1990



pieghe blande	120°-180°
pieghe aperte	70°-120°
pieghe chiuse	30°- 70°
pieghe serrate	10°- 30°
pieghe isoclinali	0°- 10°



IMMERSIONE DELLE CERNIERE DELLE PIEGHE

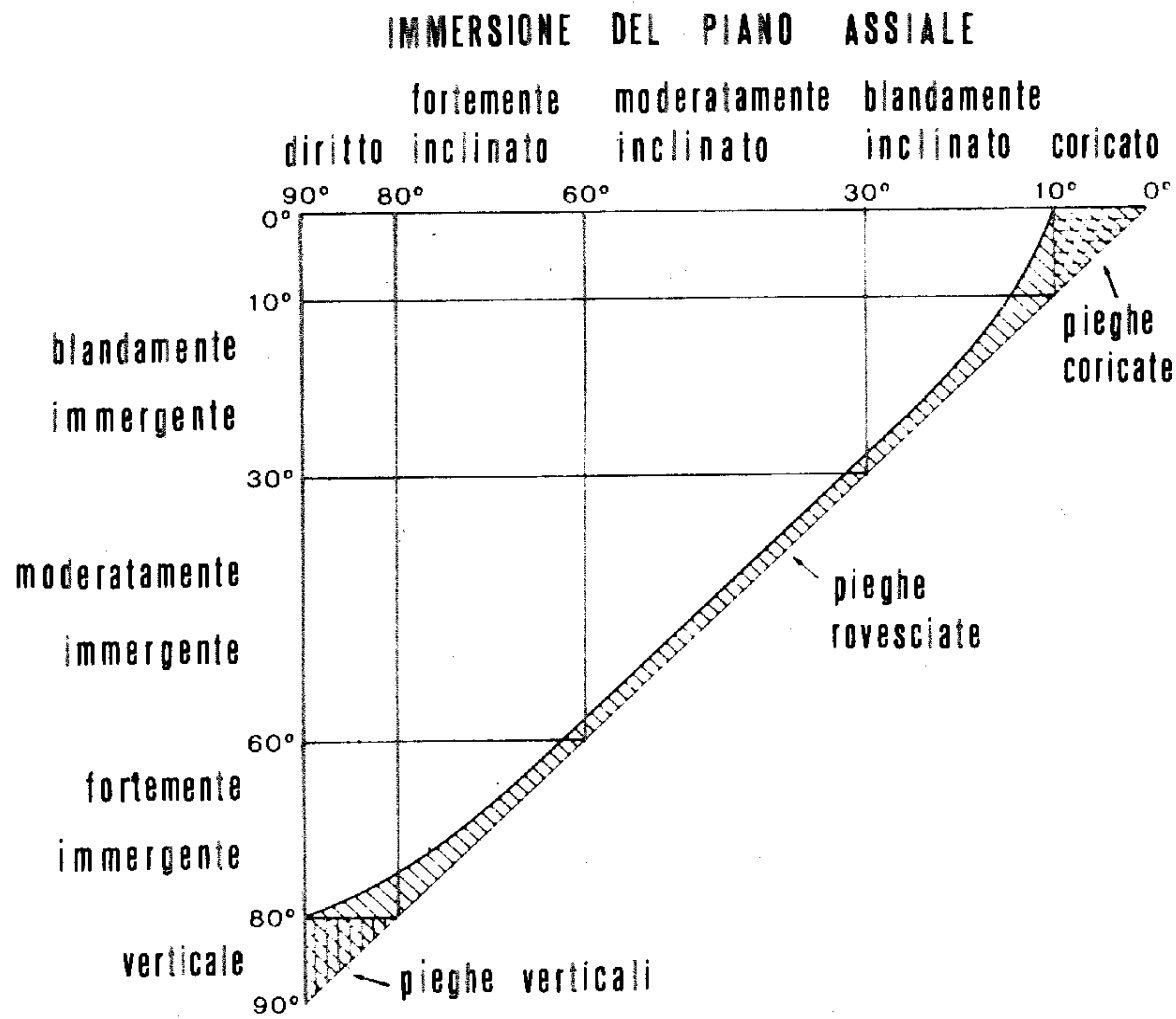


Fig. 78 - Diagramma classificativo delle pieghe sulla base delle relazioni tra immersione del piano assiale ed inclinazione della linea di cerniera (da ROBERTS, 1982).

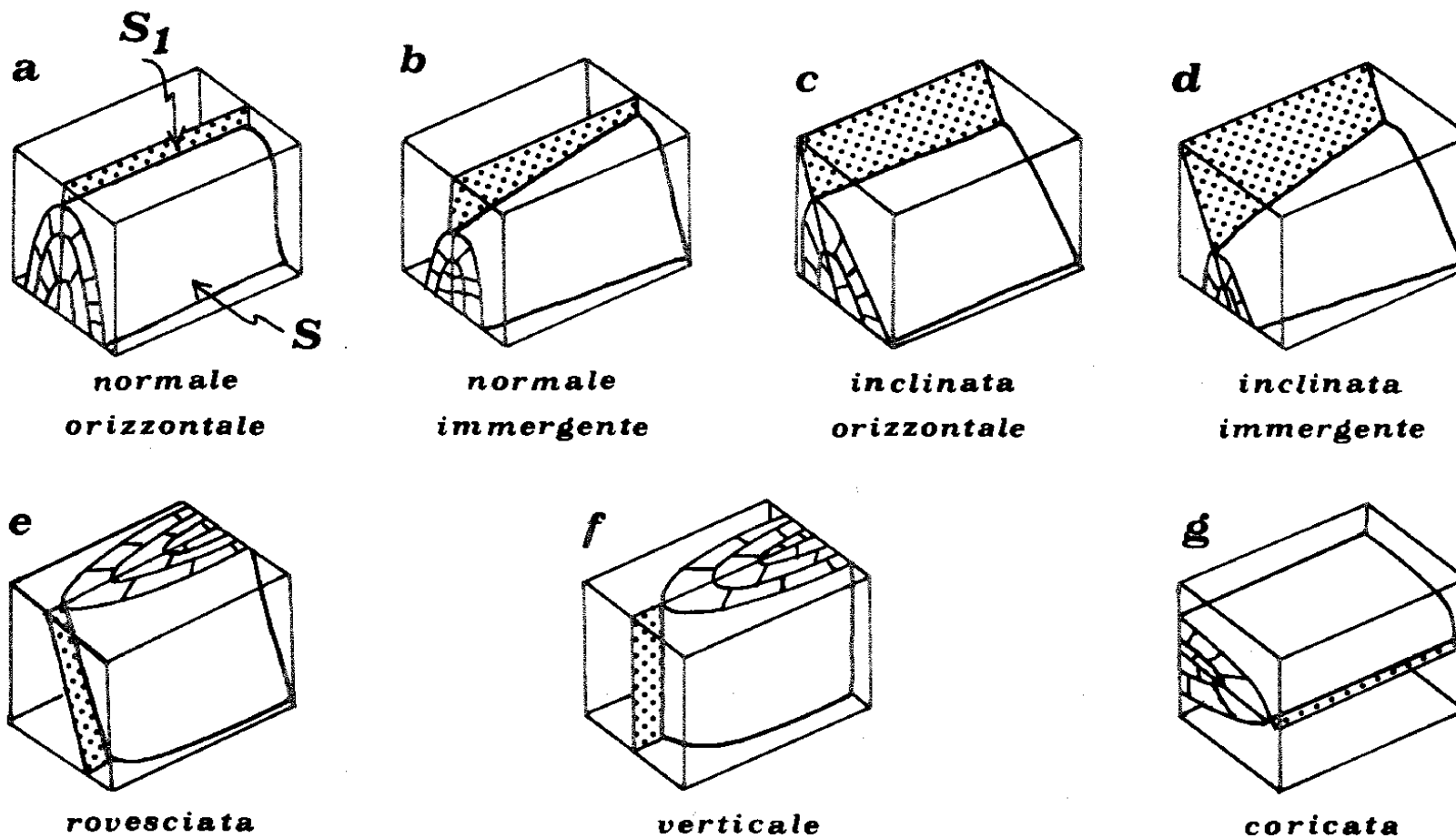
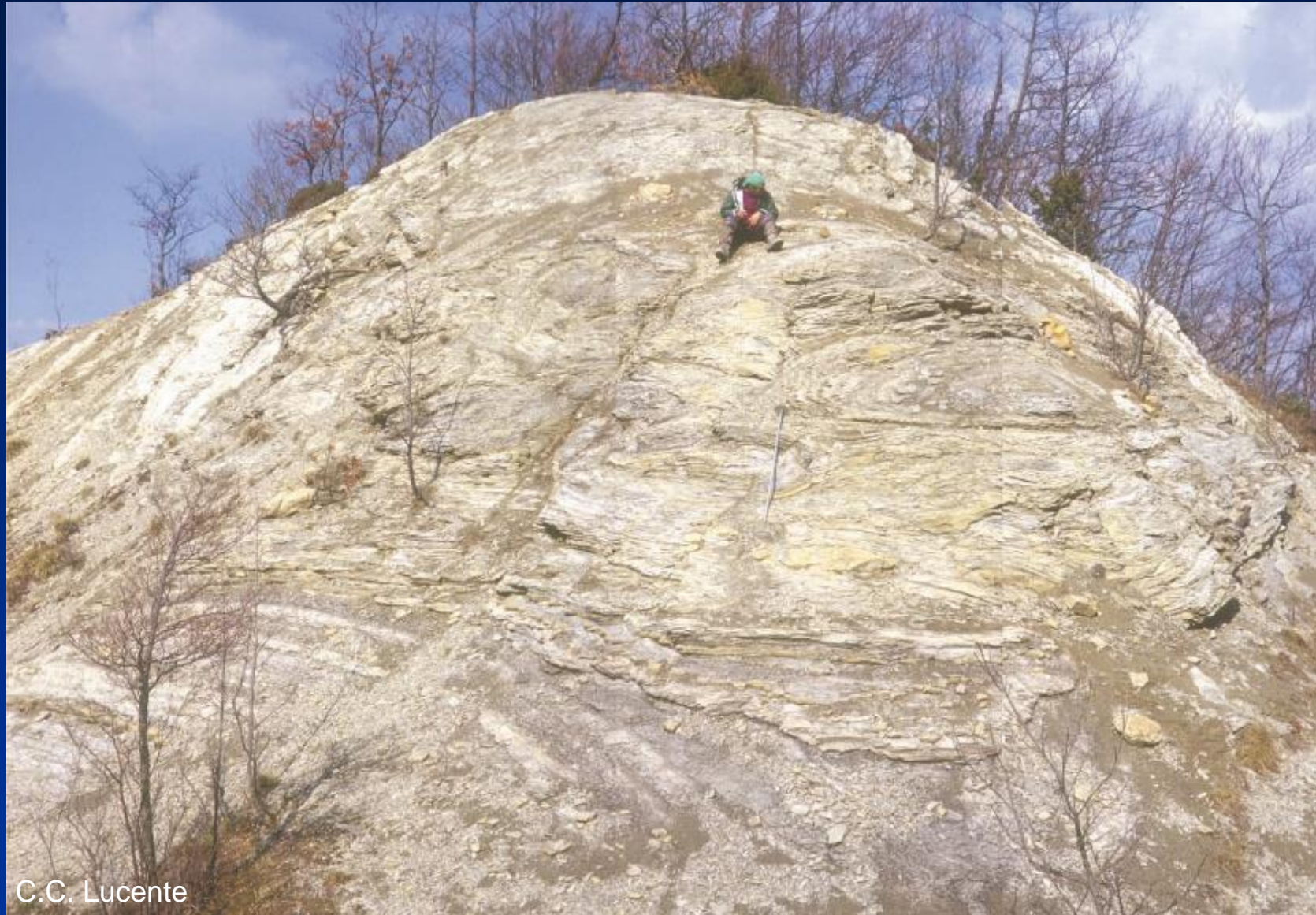


Fig. 79 - Diagrammi tridimensionali di pieghe secondo la classificazione del diagramma di fig. 78.



C.C. Lucente

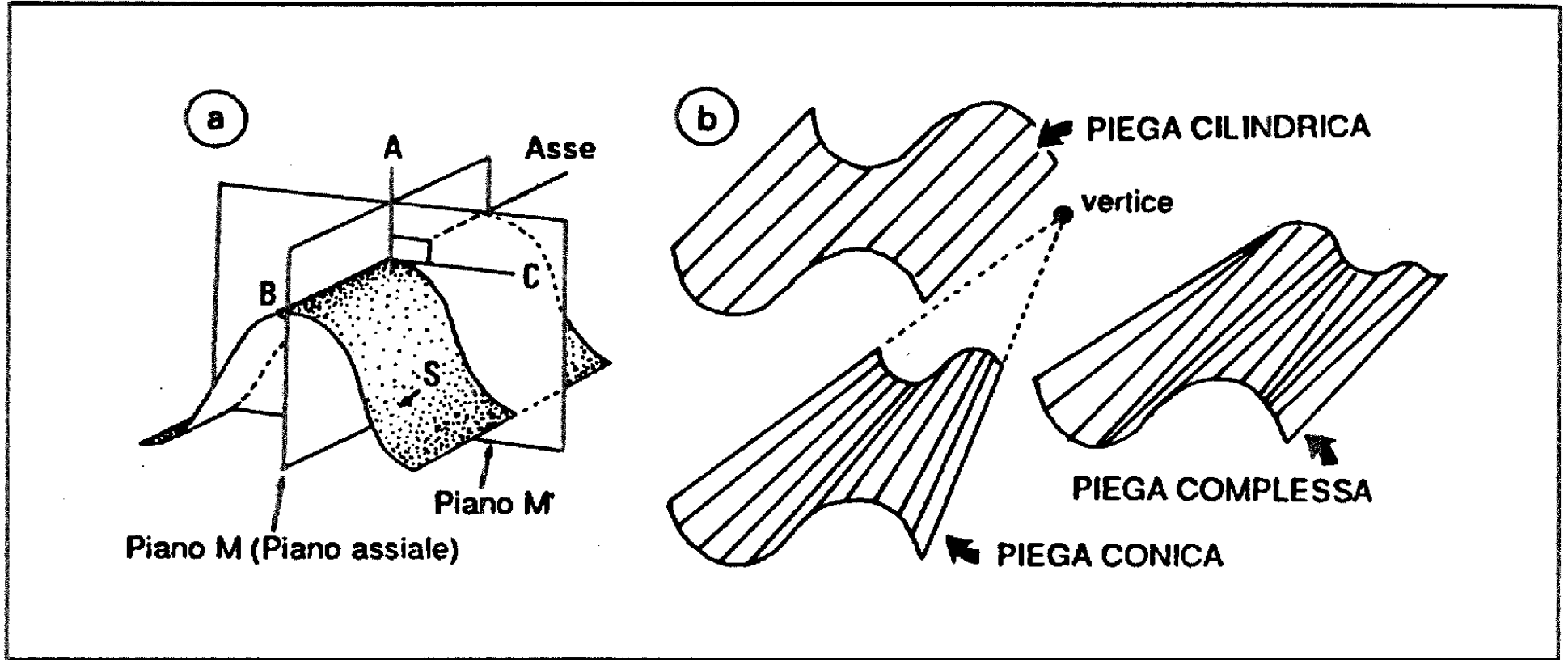


Figura 8.5. a) Piani di simmetria (M e M') ed assi geometrici (A, B, C) di una piega; b) superficie piegata descritta secondo le sue generatrici (piega cilindrica, conica e complessa).

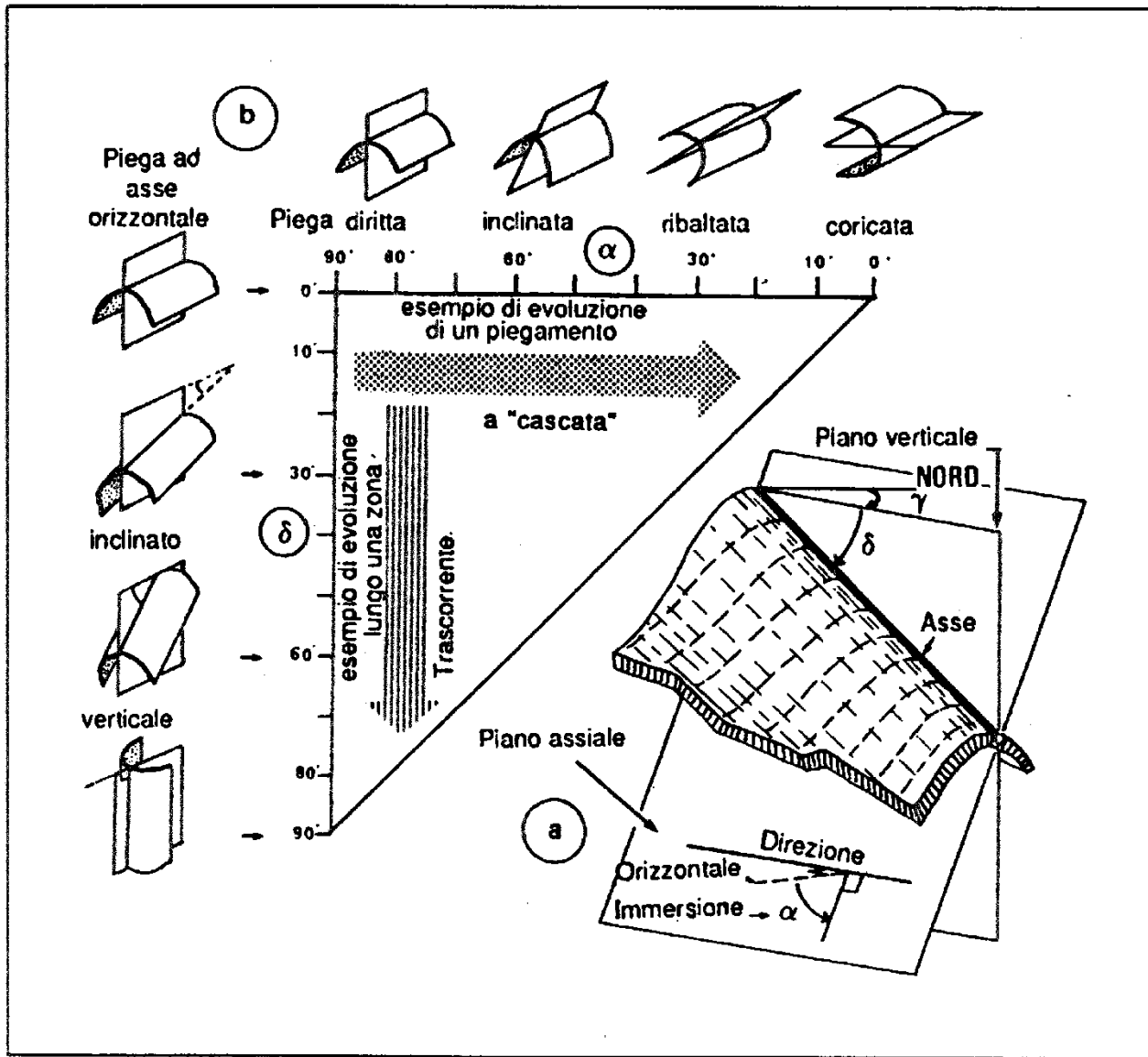


Figura 8.4. Diagramma di Fleuty (1964, Proc. Geol. Ass. Lond., 75, 461-492) che rappresenta le pieghe in funzione dell'immersione (δ) dell'asse e dell'inclinazione (α) del piano assiale.

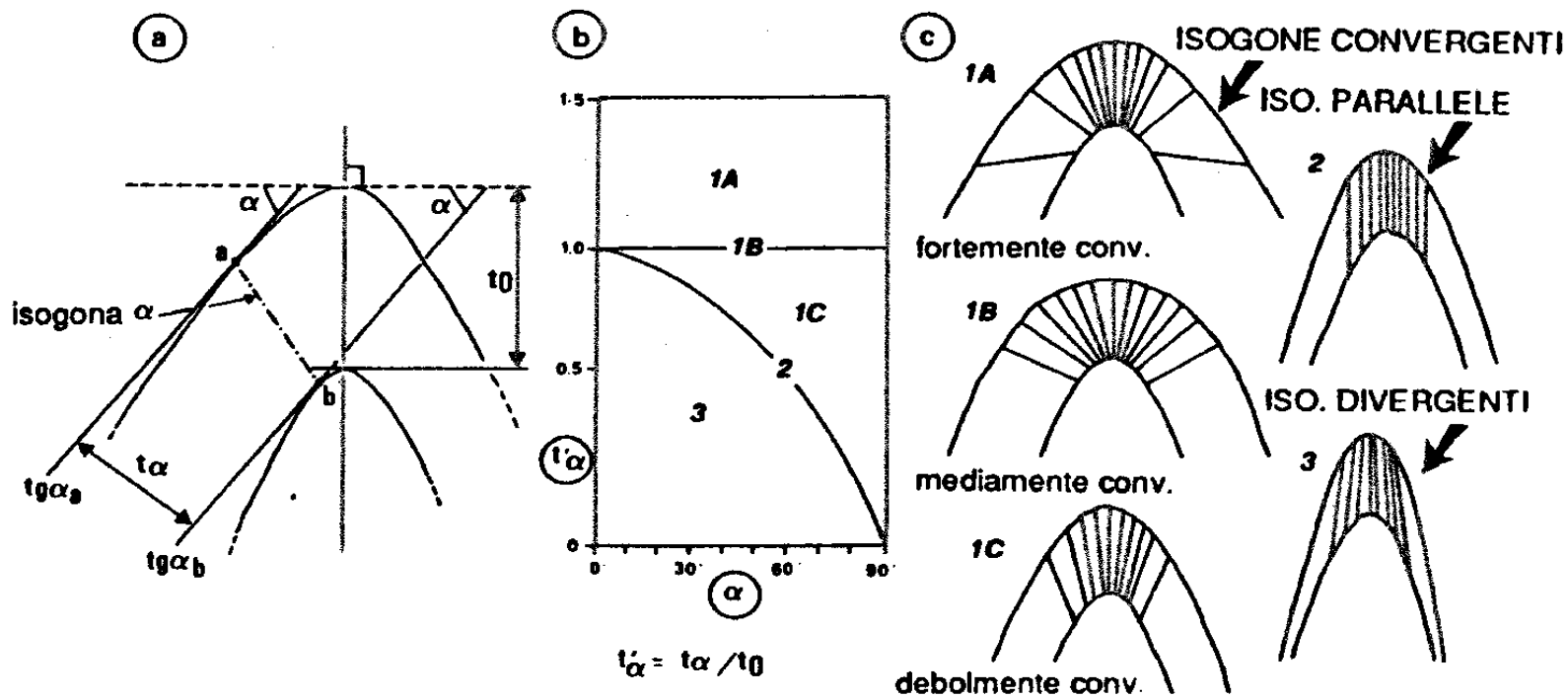
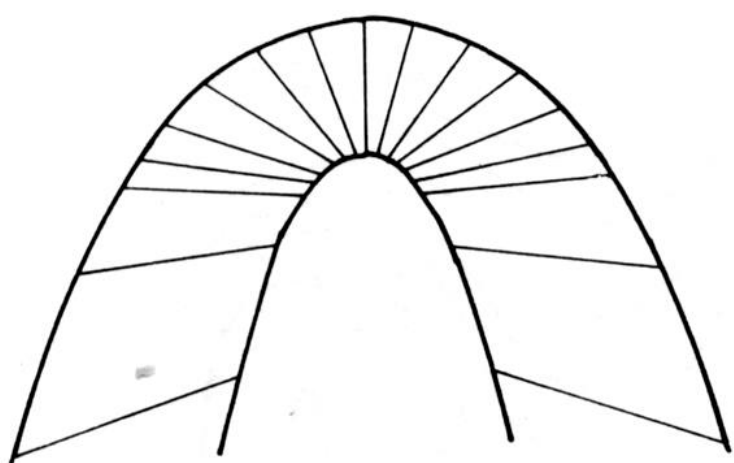
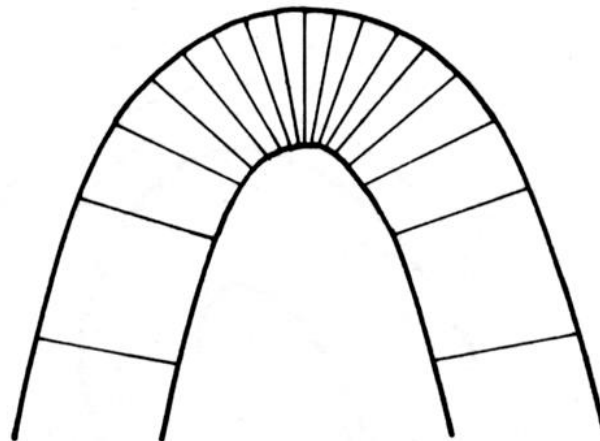


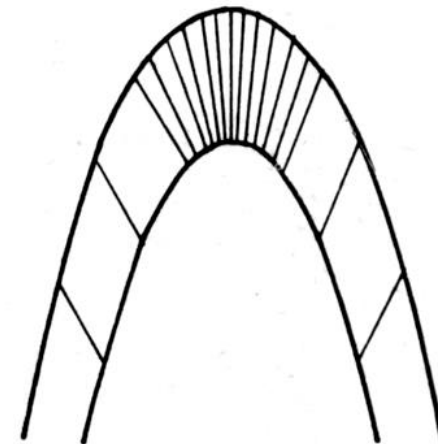
Figura 8.6. Classificazione delle pieghe secondo Ramsay (1967, McGraw Hill, 568 p.): a) determinazione dei valori di t_α e t'_α e costruzione dell'isogona a lungo una sezione della piega; b) diagramma di t'_α in funzione di i_α che definisce le diverse classi delle pieghe; c) geometria delle isogone delle pieghe di differenti classi.



1A



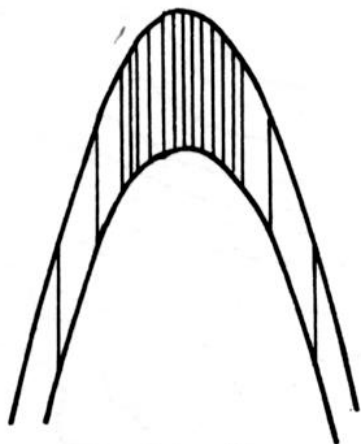
1B, Parallel



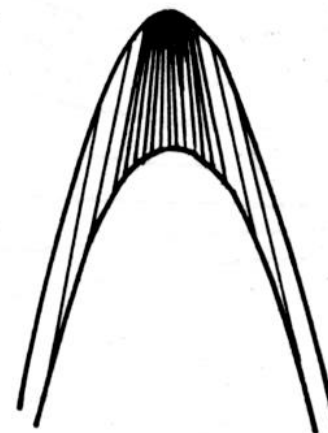
1C

Class 2

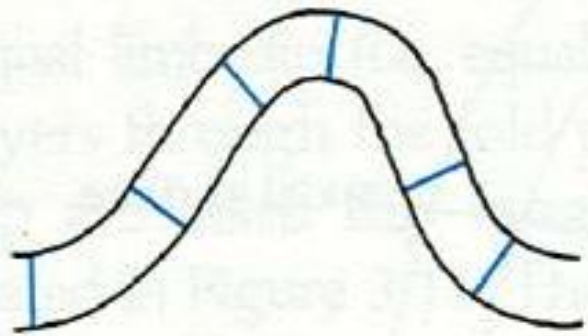
Class 3, divergent isogons



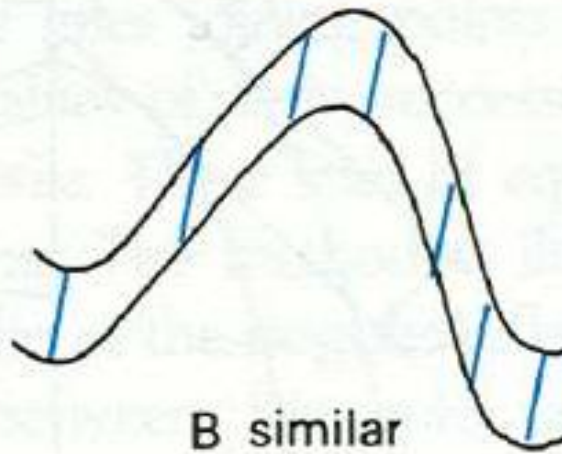
2, Similar



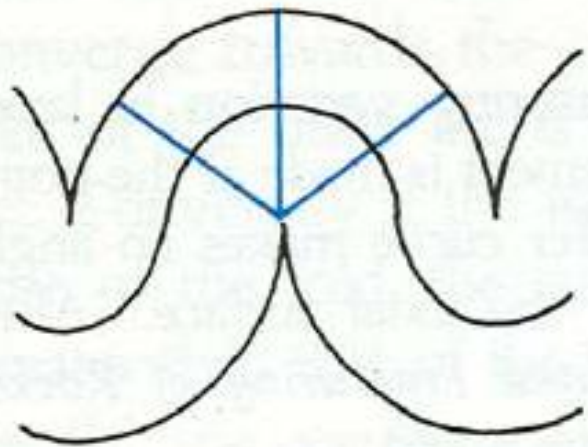
3



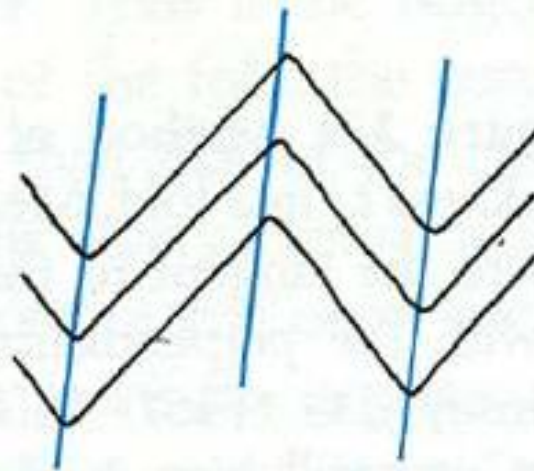
A parallel



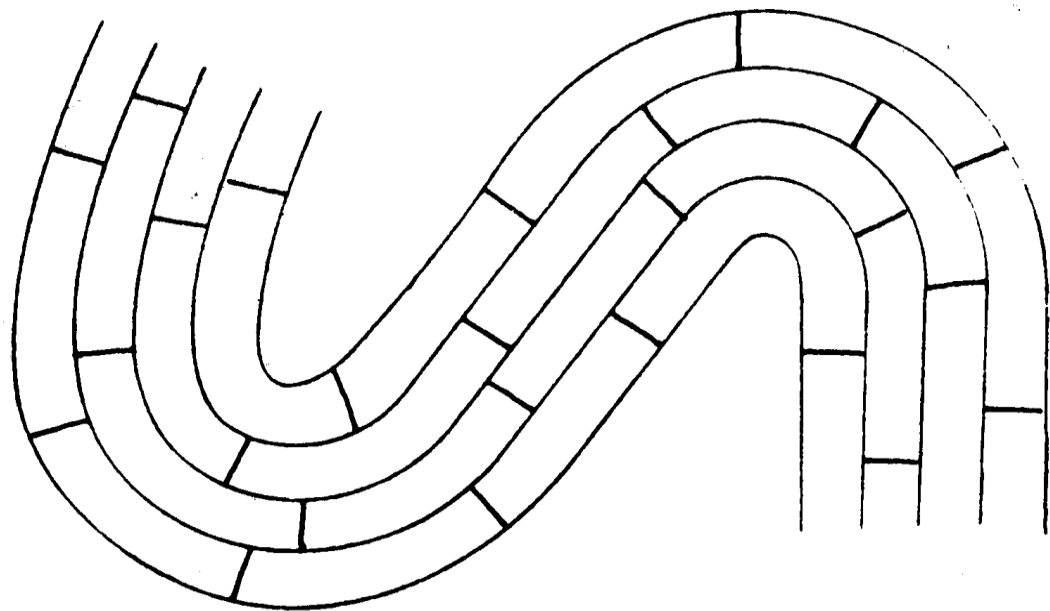
B similar



C concentric



D chevron



Pieghe parallele

Da Boccaletti & Tortorici, 1987

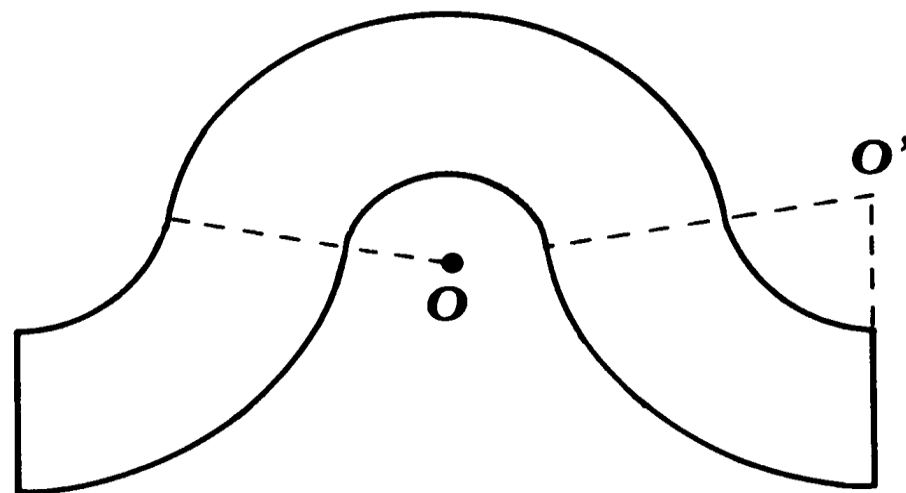
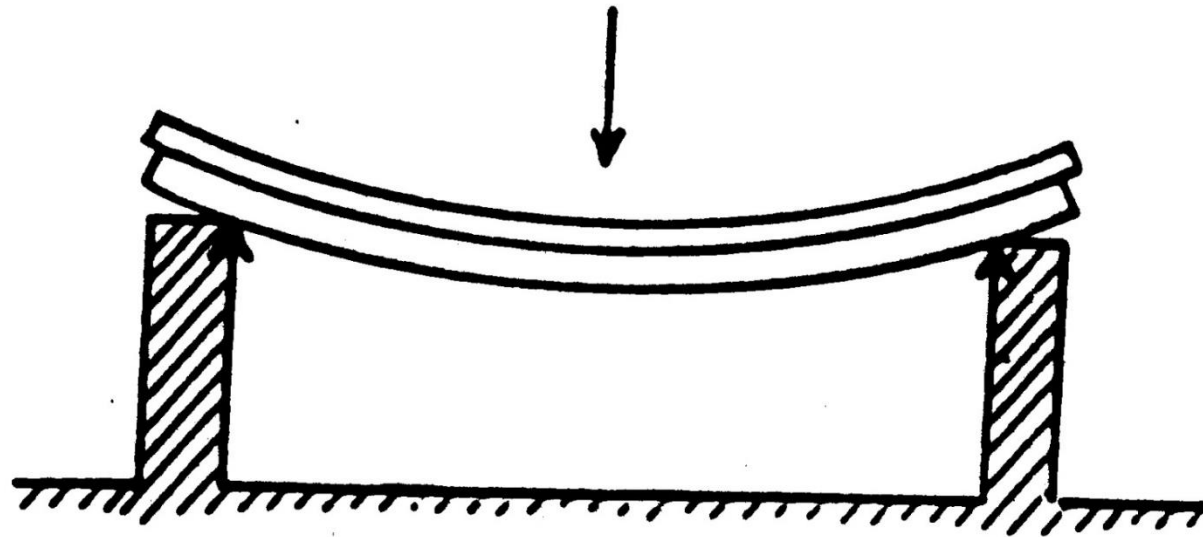
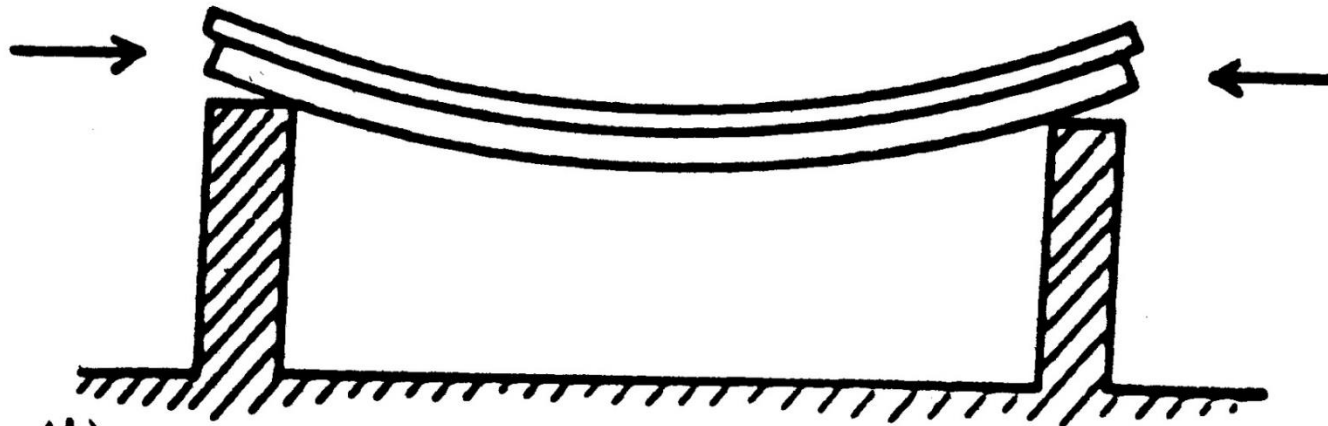


Fig. 66 - Esempio di piega concentrica. I punti O e O' rappresentano i centri origine dei relativi archi di circonferenza.



(a)

Bending

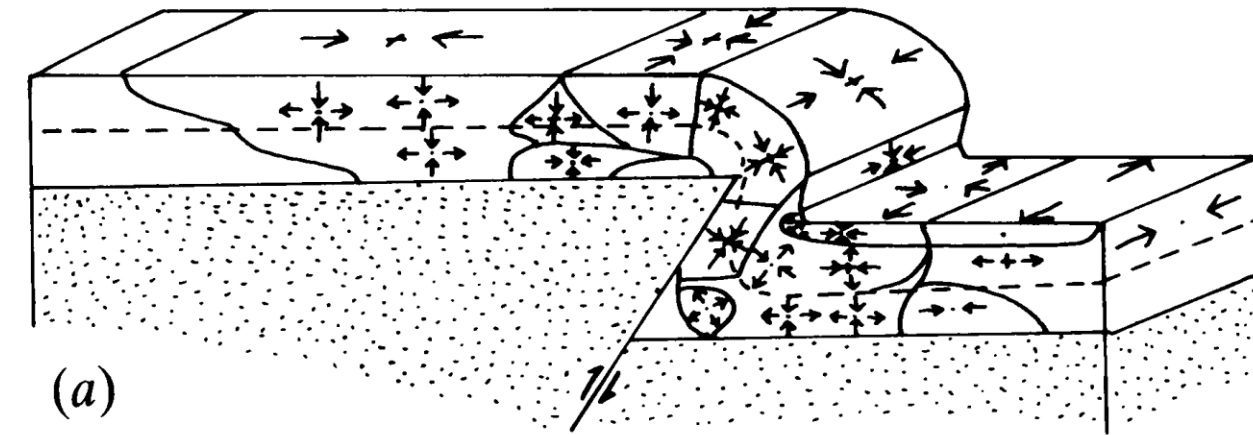


(b)

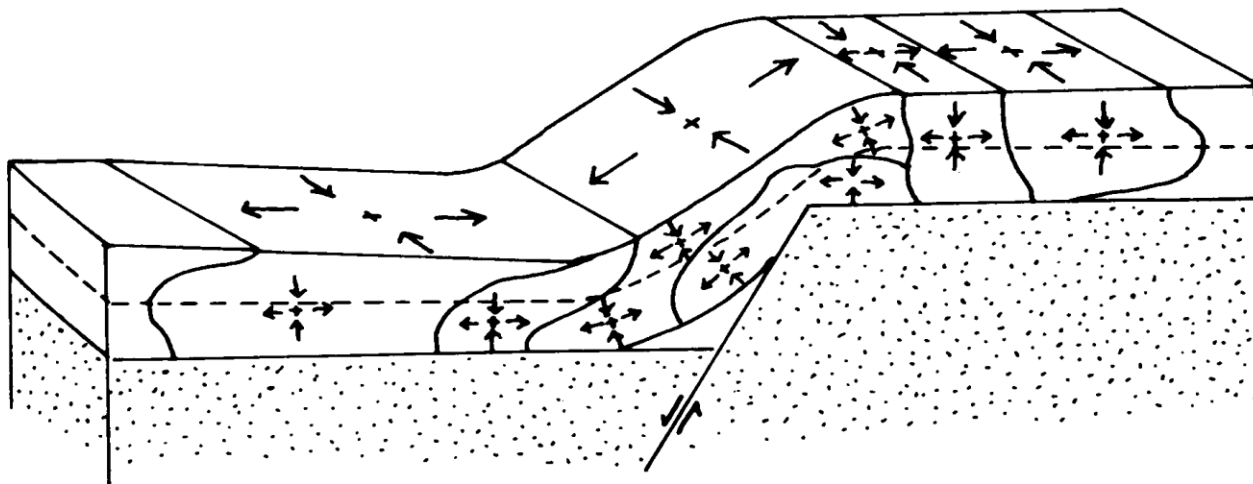
Buckling

Pieghe per flessione passiva

Bending



(a)



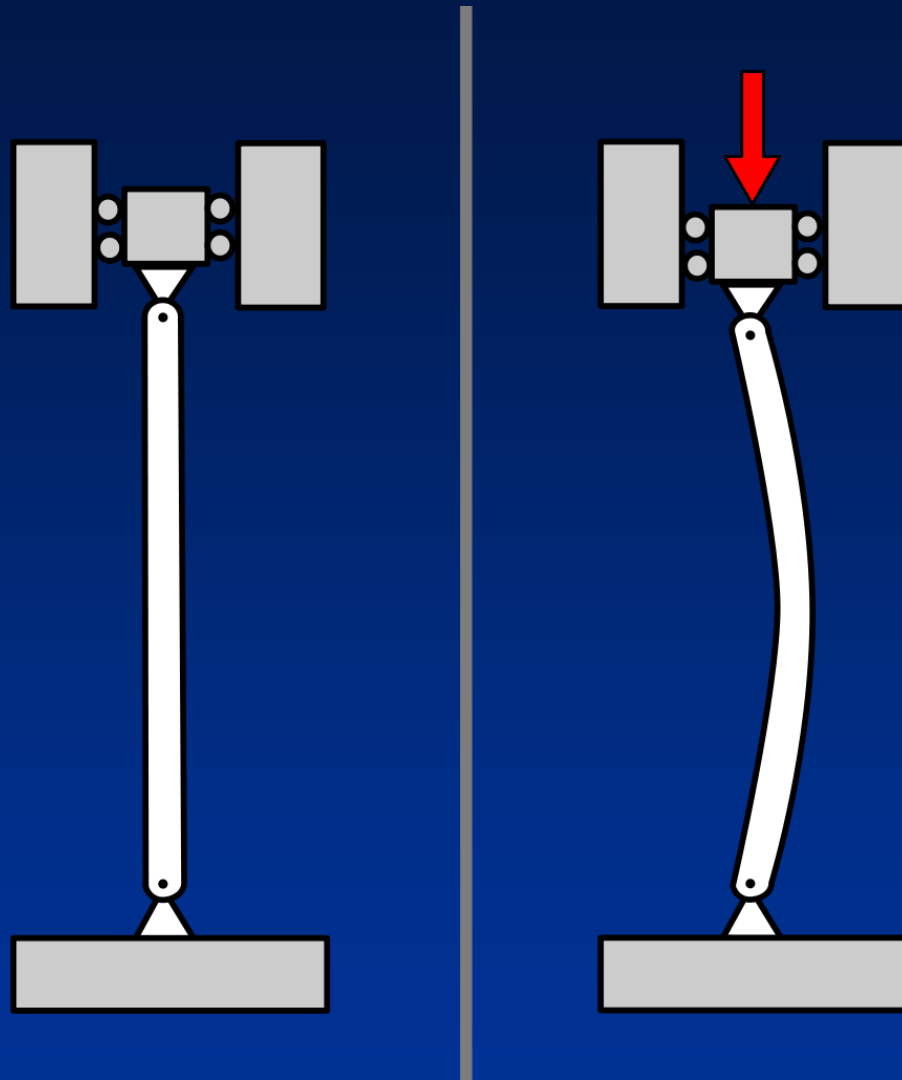
(b)

Fig. 10.20. Experiments showing the effects of (a) reverse and (b) normal faulting in a rigid basement on a layered, ductile cover. (After Ameen 1988.)

Buckling

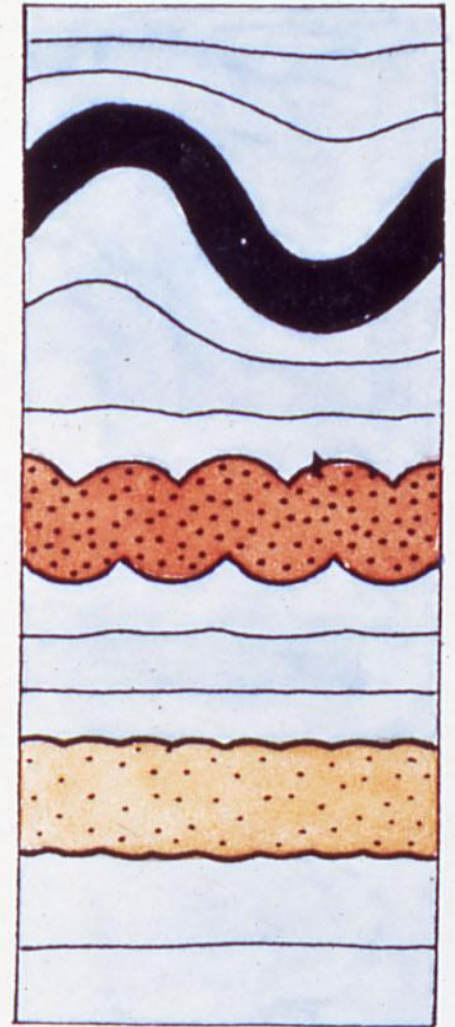
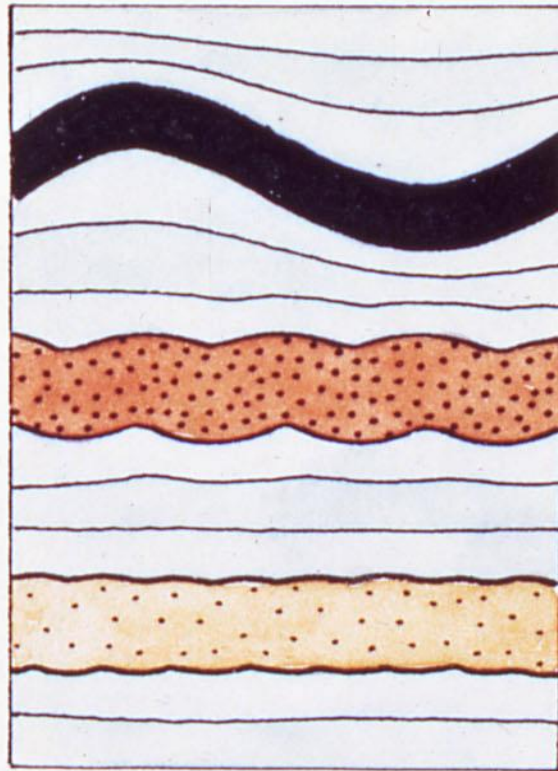
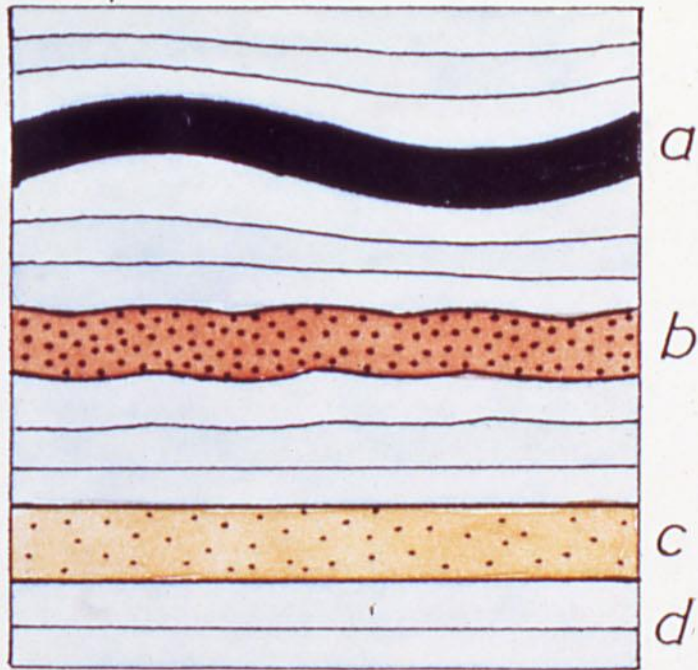


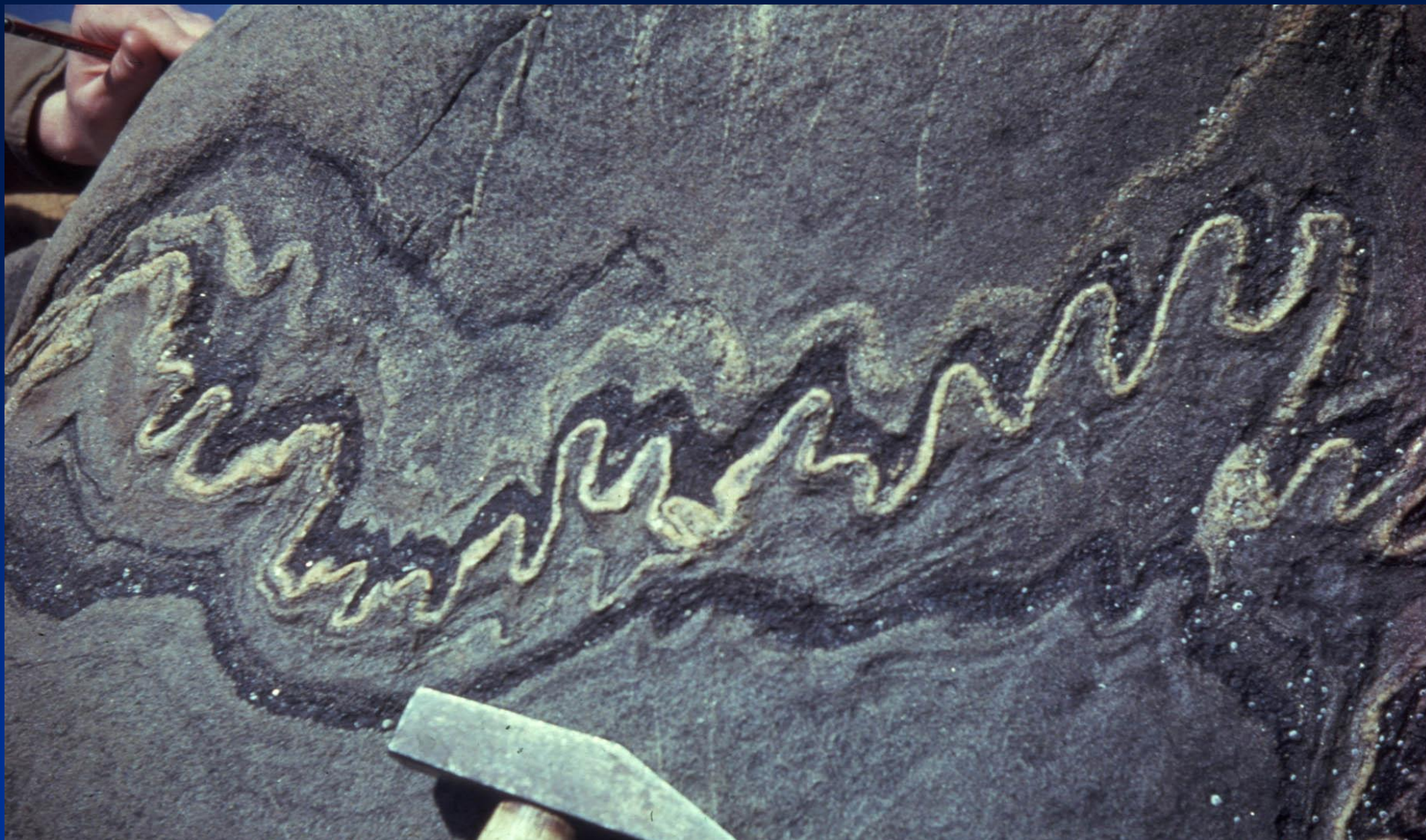
High heat resulted in thermal expansion of these rails, buckling this section of railway. Da U.S. Department of Transportation. Public domain, last modified 2019. <https://toolkit.climate.gov/image/1001>



By Buckled_column.png: Original uploader was Spindustrious at en.wikipediaderivative work: Mircalla22 (talk) - Buckled_column.png, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=7648435>

A.

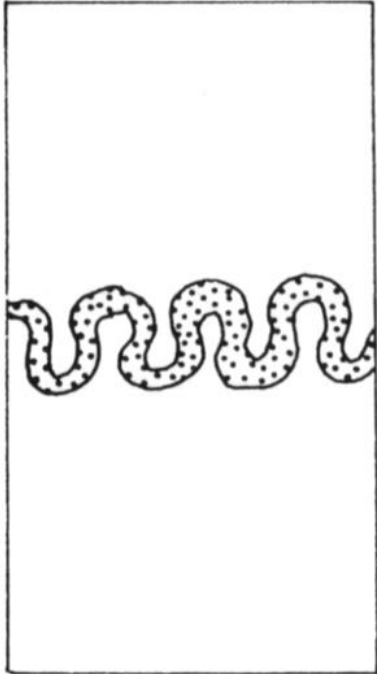




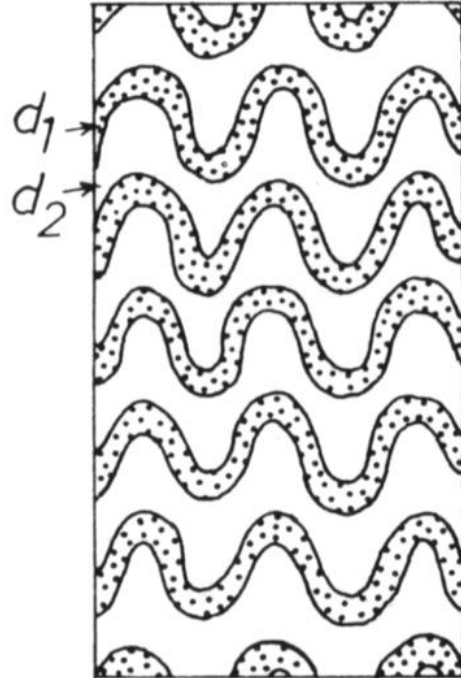
Da Ramsay & Huber, 1987

Pieghe ptigmatiche o a elastico

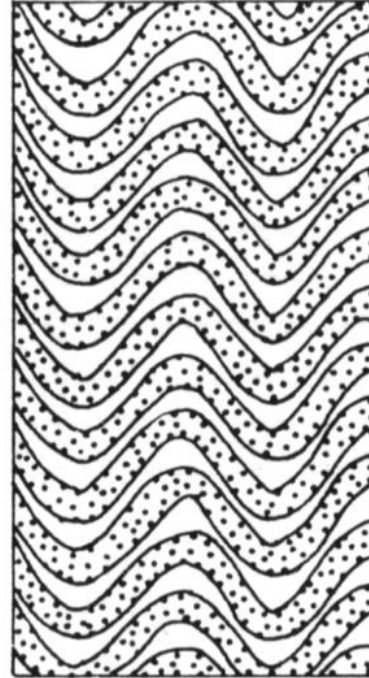
A. $n = \infty$



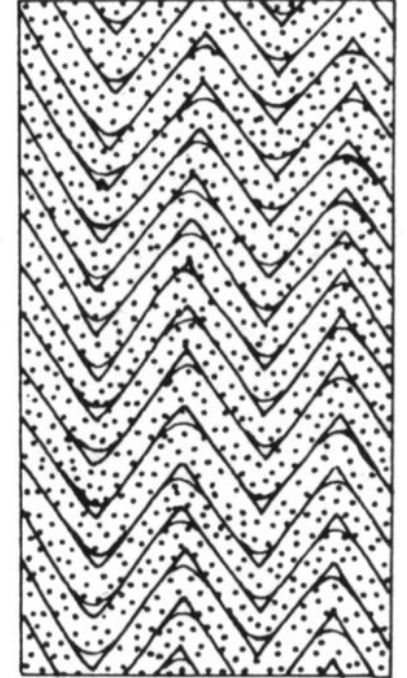
B. $n = 4$



C. $n = 1$



D. $n = 0.2$



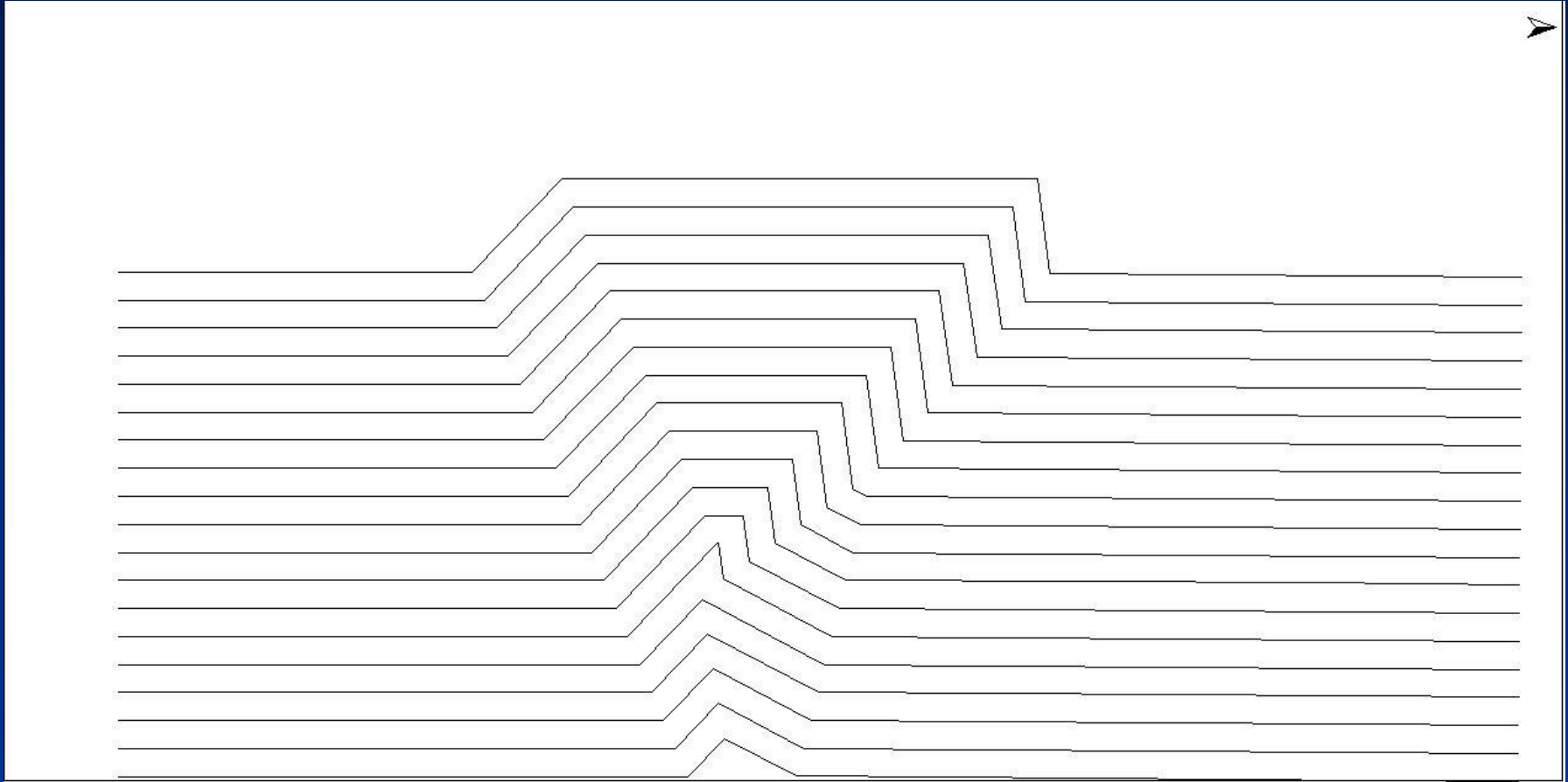
Da Ramsay & Huber, 1987

$$n = d_2 / d_1$$

Rapporto tra gli spessori dei livelli incompetenti e competenti

Pieghe chevron e “a scatola” (box fold)





Semplice modello in forwarding da Move (software licenses by courtesy of Petroleum Expert)

Fault-related or thrust-related folds

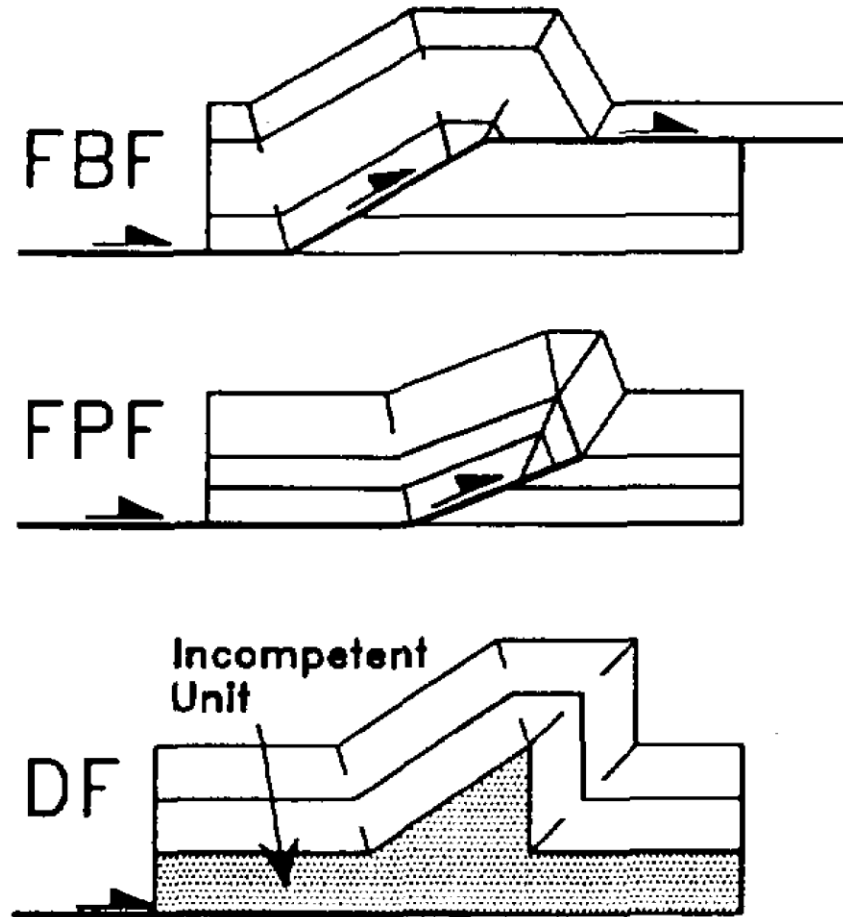


Fig. 1. Three major types of thrust-related folds in fold-and-thrust belts: fault-bend fold (FBF), fault-propagation fold (FPF), and detachment fold (DF).

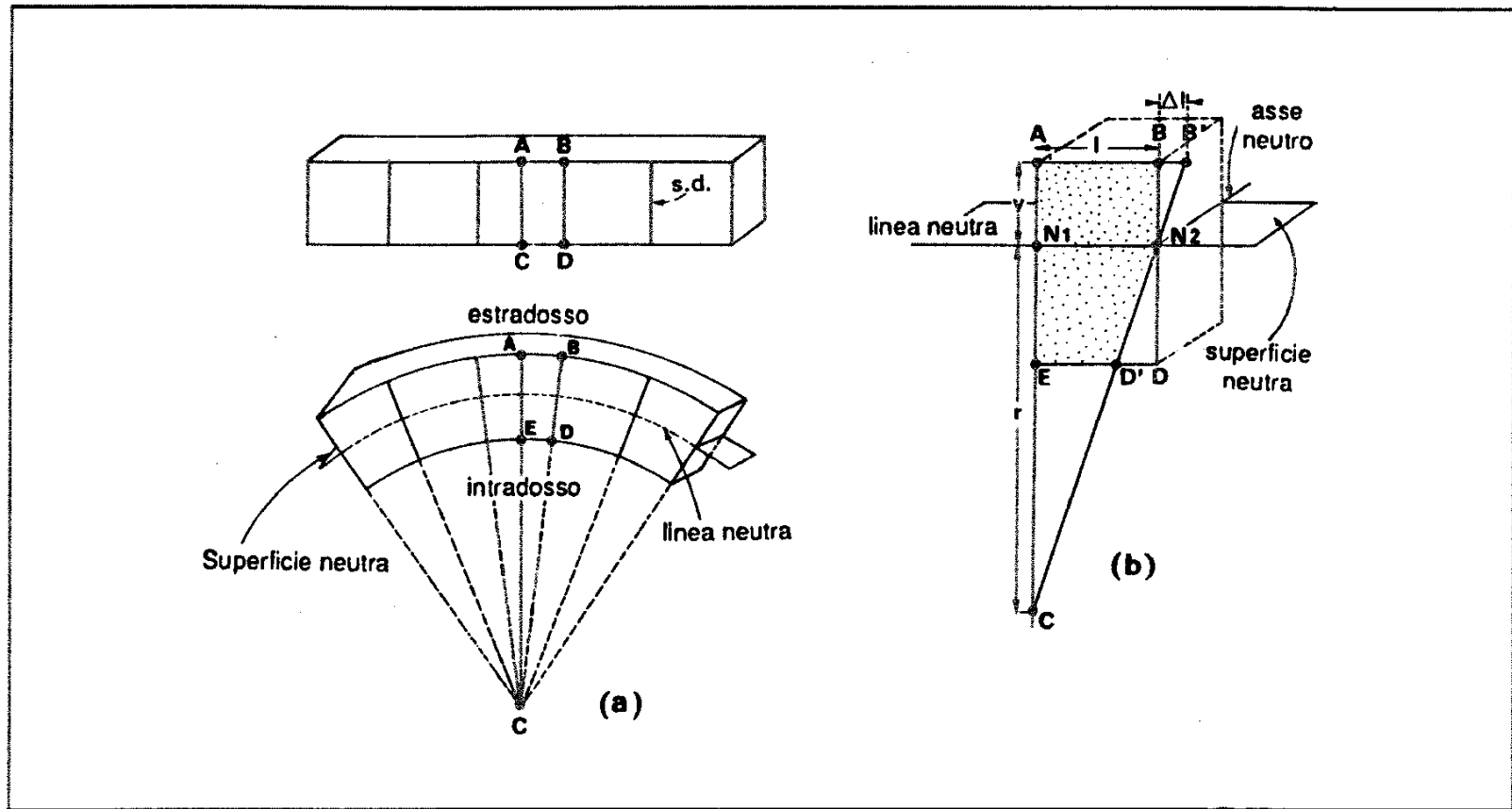


Figura 8.11. Sforzi in una trave in flessione pura (trave in appoggio libero).

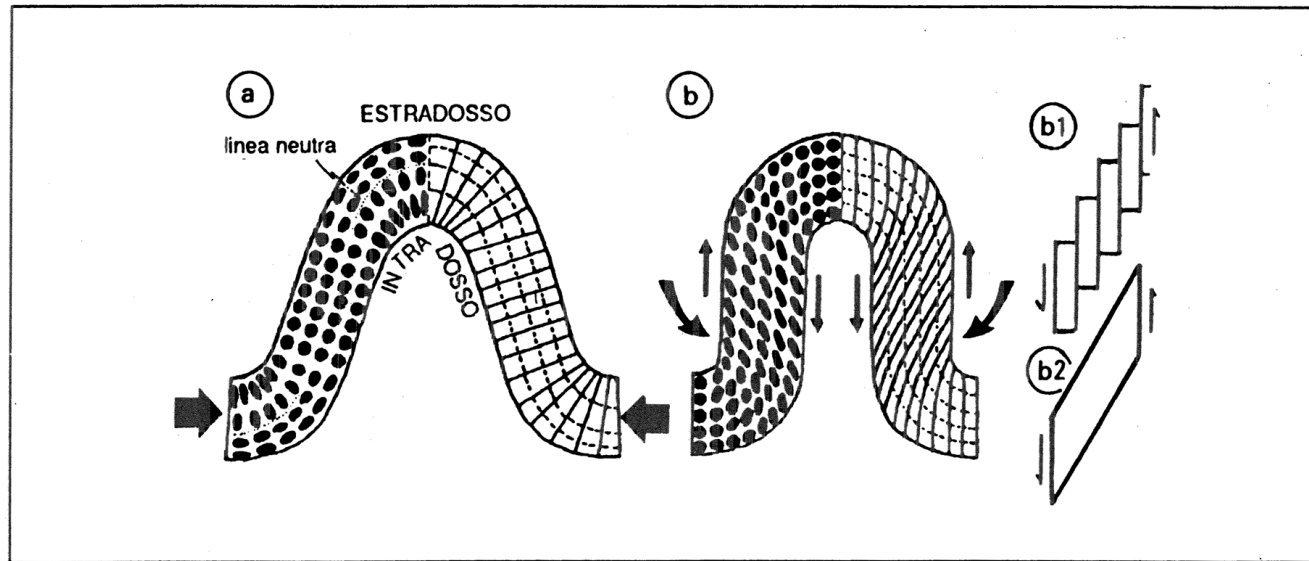


Figura 8.13. Piega monostrato a deformazione di cerniera (a) e dei fianchi (b) con taglio discontinuo (b₁) o continuo (b₂).

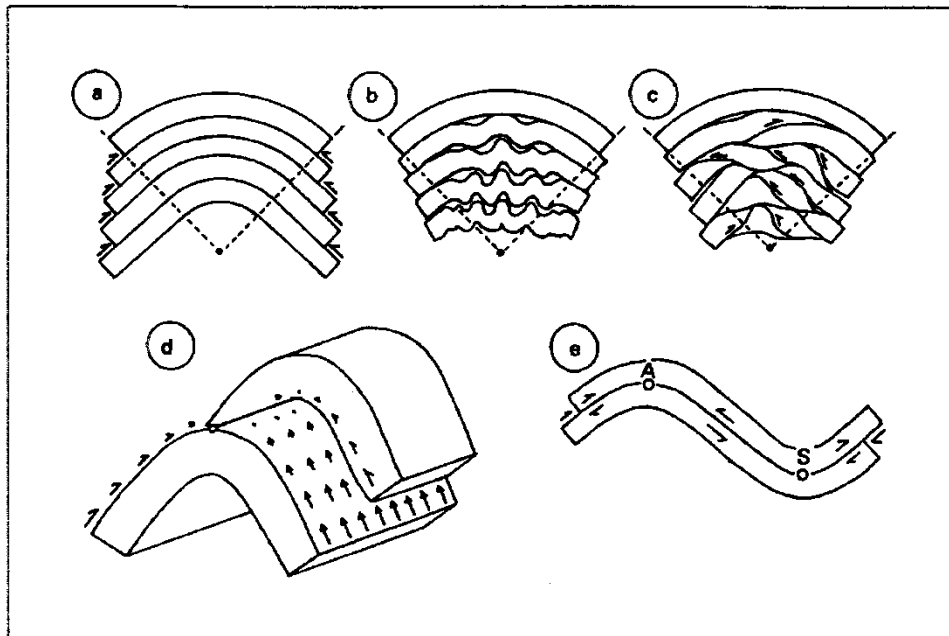


Figura 8.17. Piegameto isopaco di un pacco di strati: a) modello ideale ed accomodamento della deformazione per micropiegamenti b) o per tagli embriciati c), d) ed e) mostrano lo scorrimento banco su banco.

Da Mercier & Vergely, 1995

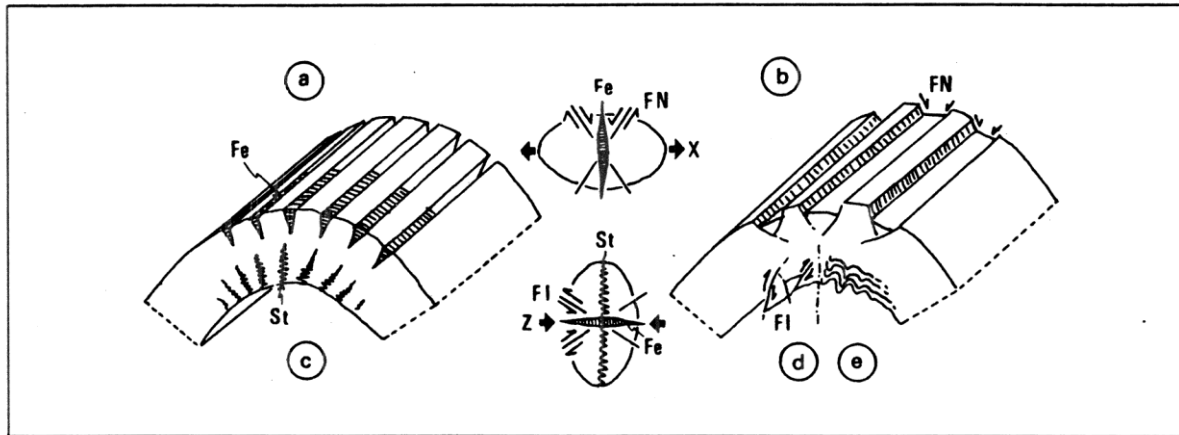


Figura 8.15. Strutture associate alle pieghe a deformazione in cerniera; a) squarci da trazione (Fe), b) faglie normali (FN), c) stiloliti (St), d) faglie inverse (FI) ed e) micropiegamenti; al centro modalità di associazione di diverse strutture.

Da Mercier & Vergely, 1996

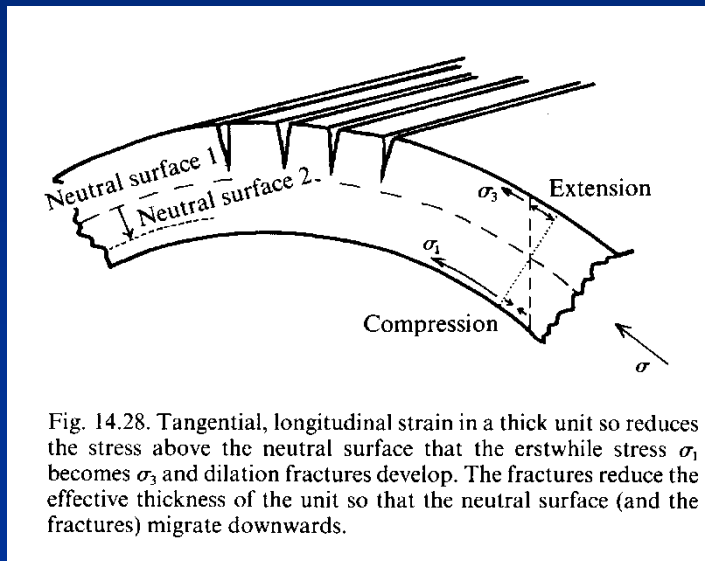
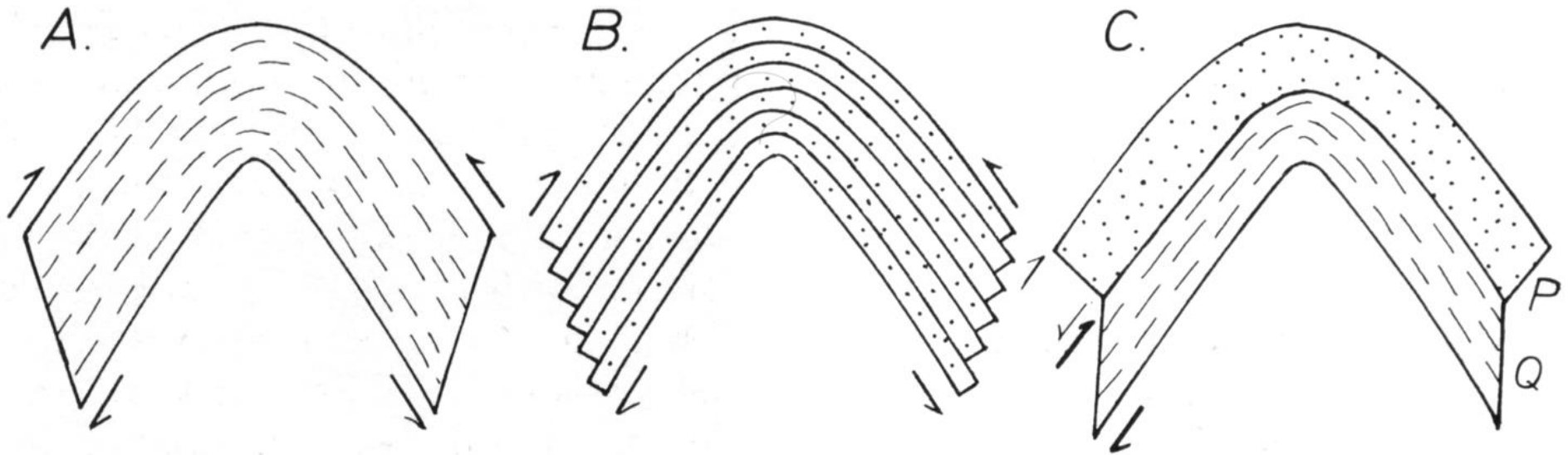


Fig. 14.28. Tangential, longitudinal strain in a thick unit so reduces the stress above the neutral surface that the erstwhile stress σ_1 becomes σ_3 and dilation fractures develop. The fractures reduce the effective thickness of the unit so that the neutral surface (and the fractures) migrate downwards.

Da Price and Cosgrove, 1990



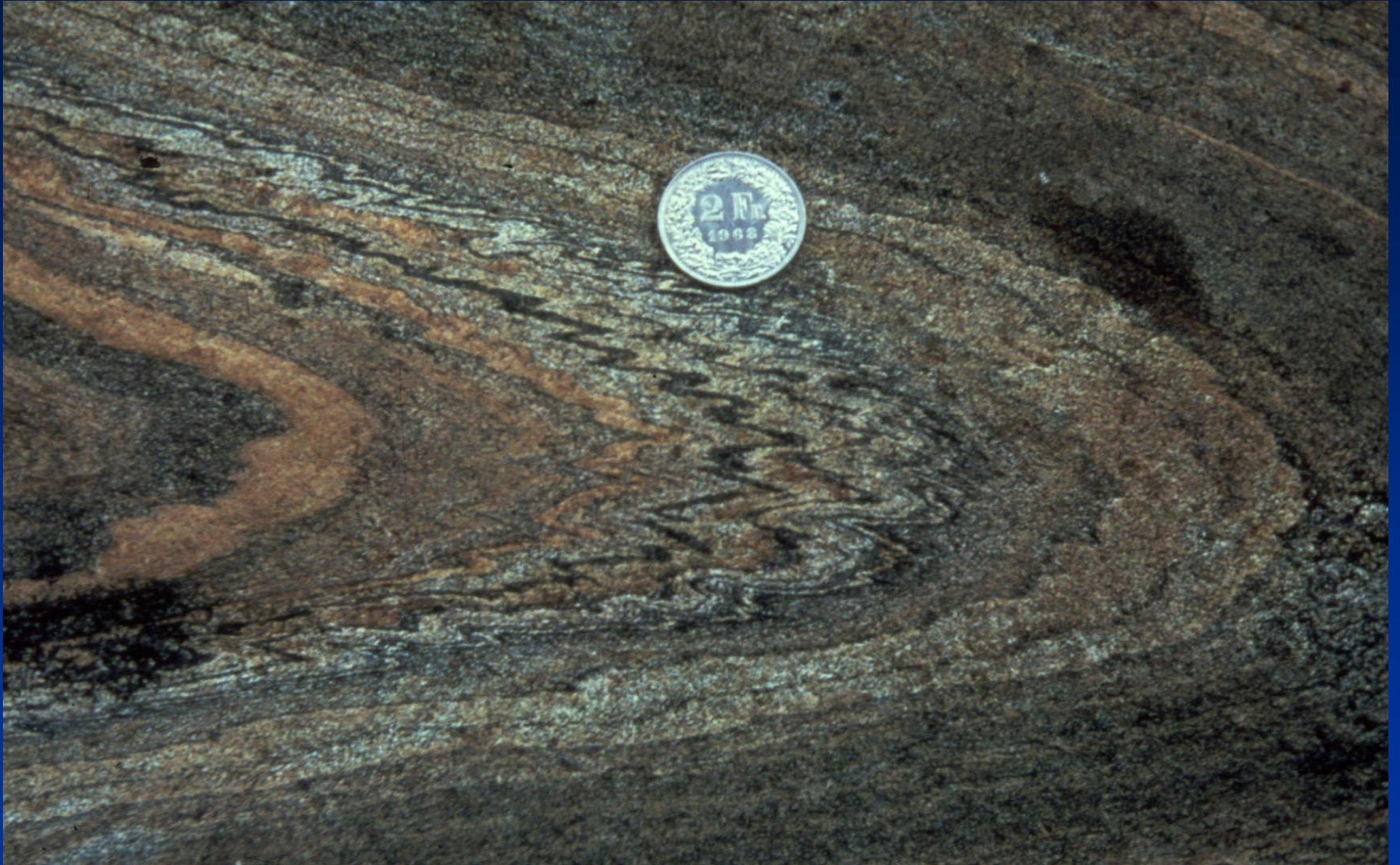
Da Ramsay & Huber, 1987

Flexural flow

Flexural slip

Misto

Pieghe parassite



Da Ramsay & Huber, 1987

Pieghe di secondo ordine Pieghe parassite

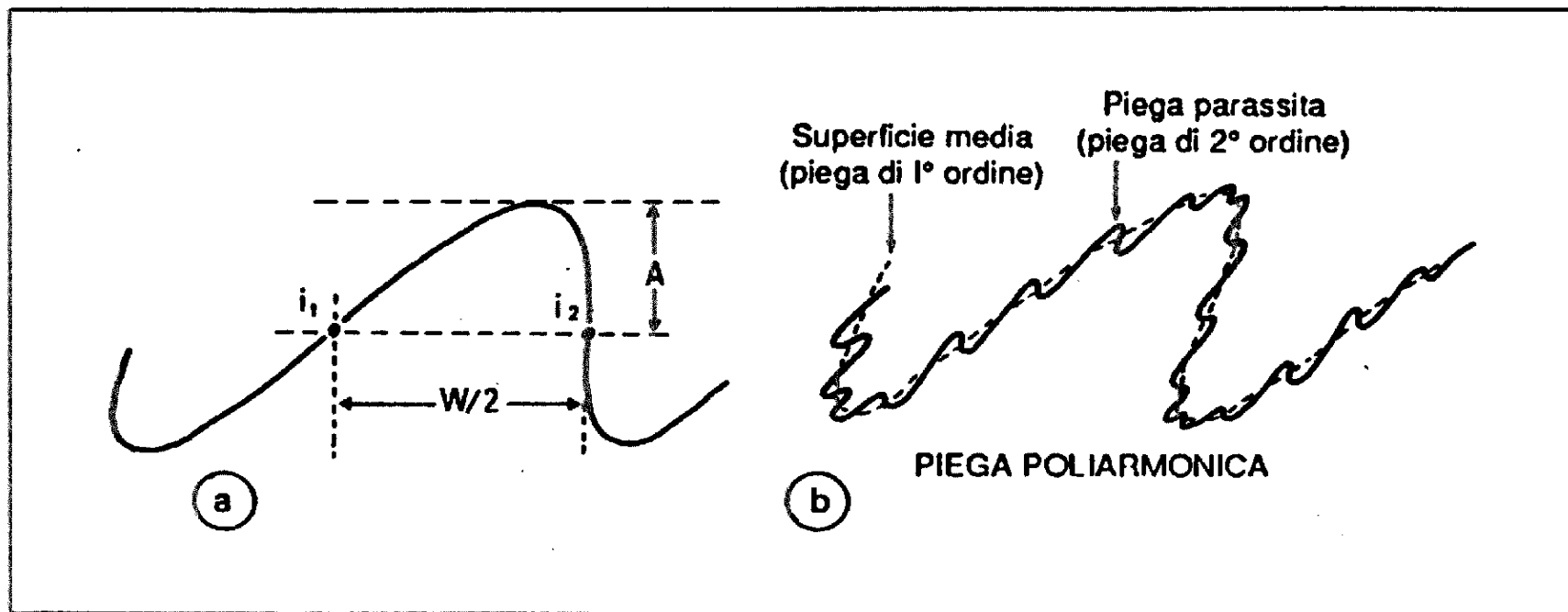
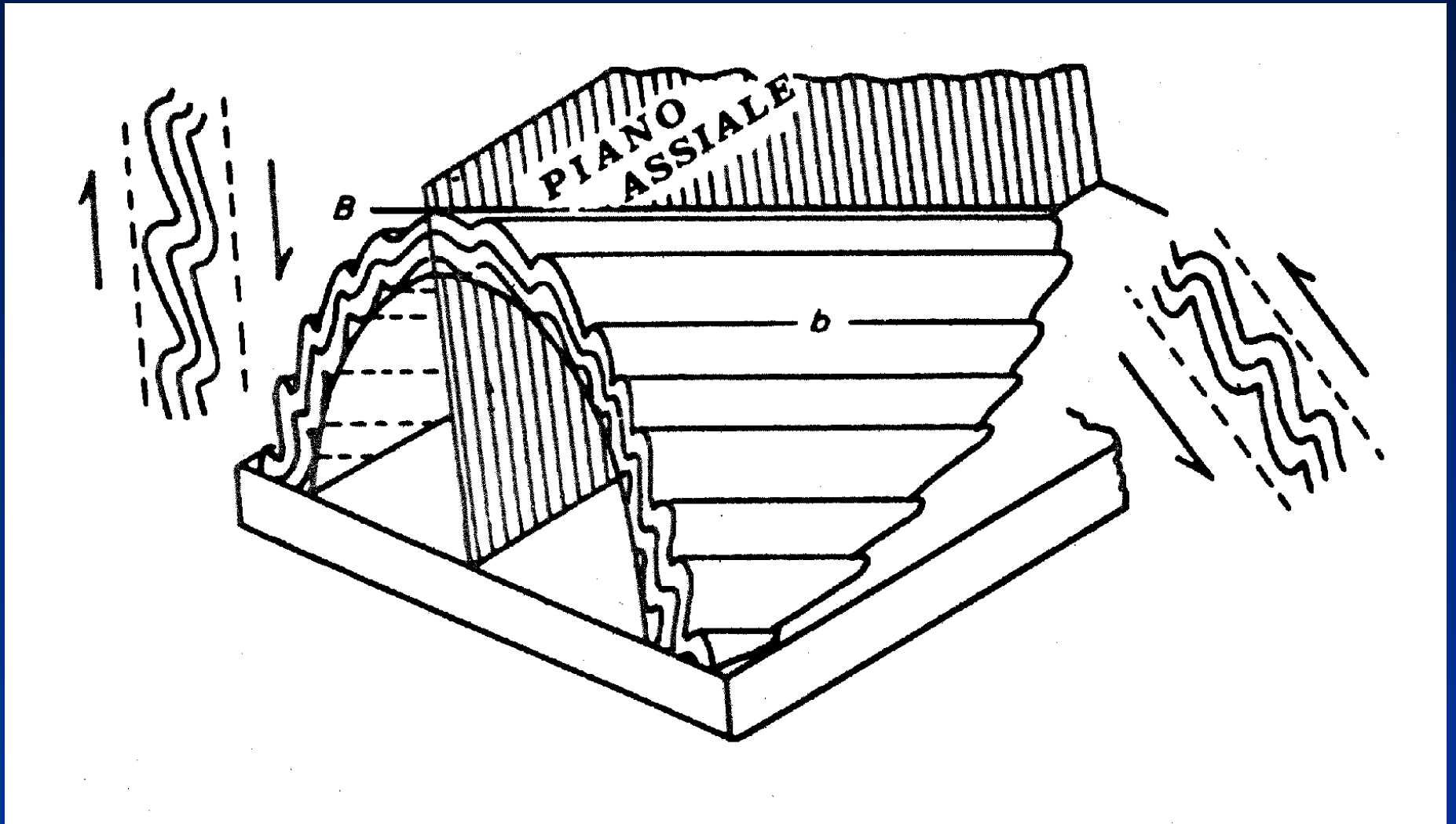
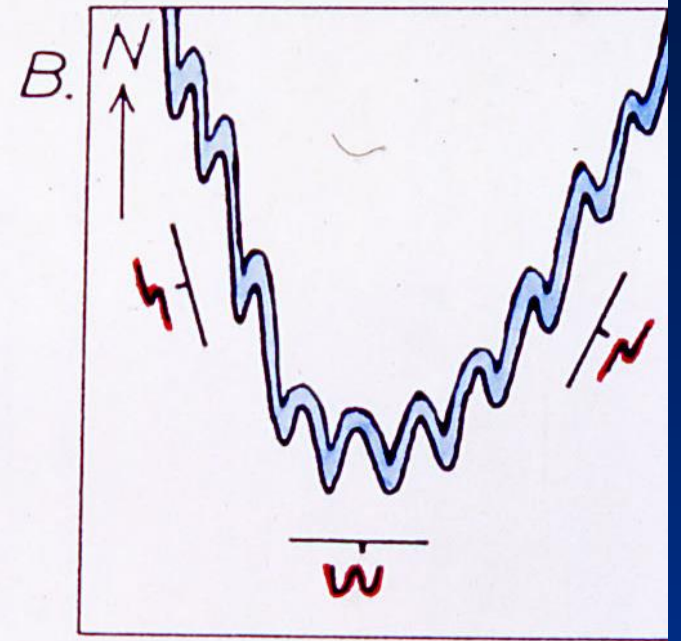
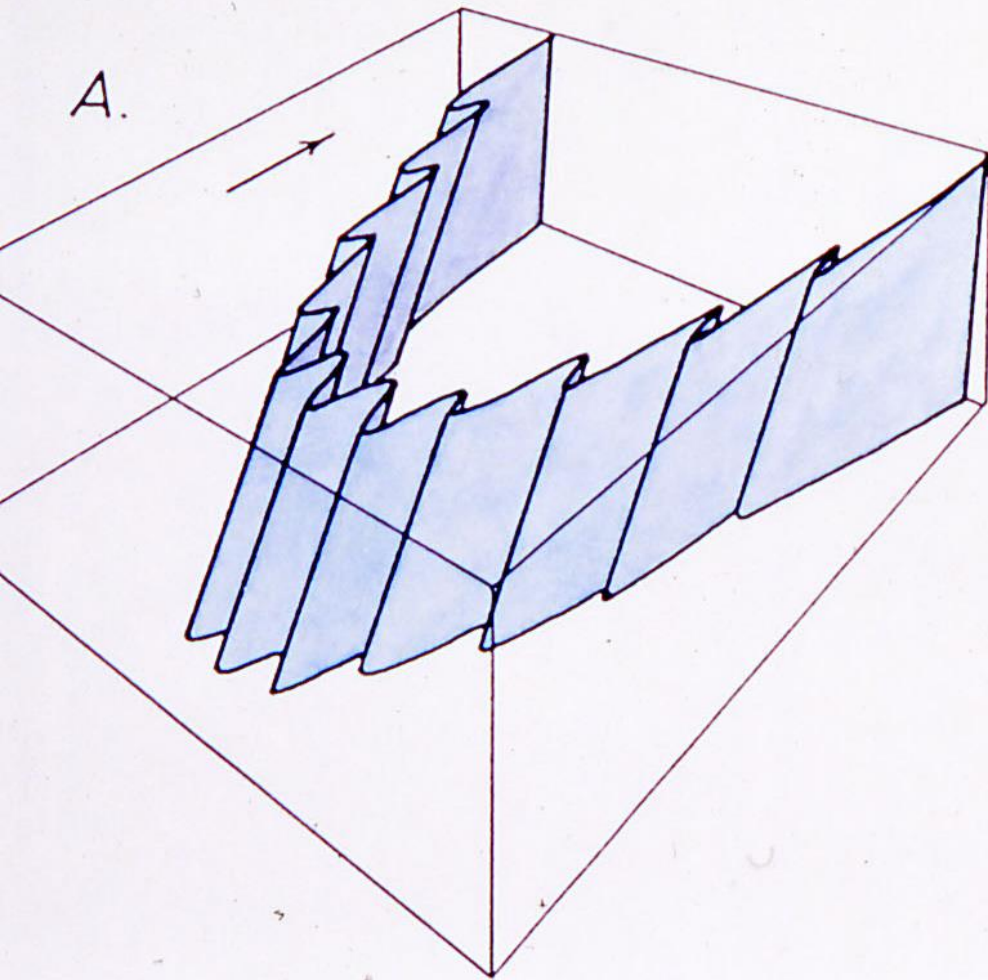


Figura 8.2. a) Ampiezza (A) e semi-lunghezza d'onda ($W/2$) di una piega; b) superficie media e pieghe parassite di una piega poliarmonica.

Da Mercier & Vergely, 1996



Da Boccaletti & Tortorici, 1987



Da Ramsay & Huber, 1987

Pieghe parassite

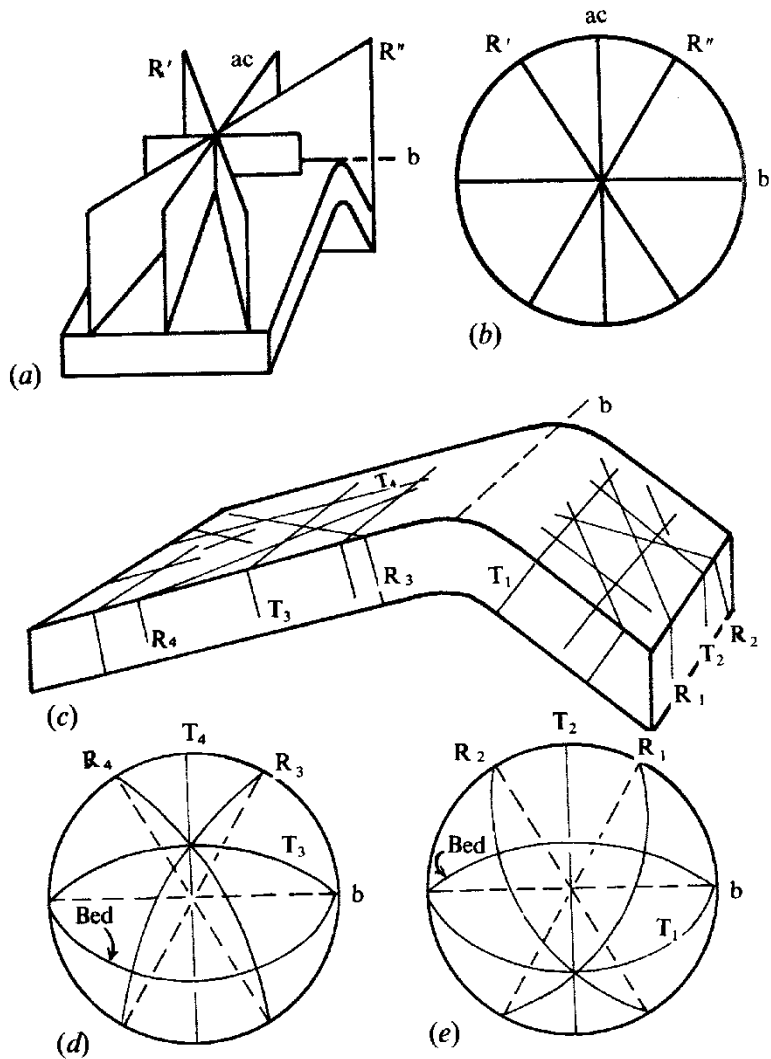


Fig. 14.20. (a) Ideal relationship of master joints to a small fold. (b) Stereographic plot of fractures shown in (a). (c) Trends of minor fractures in a folded competent unit. (d) and (e) Stereographic plots of fractures in the two limbs. R and T are shear and extension fractures respectively. (All after Price, 1966.)

Da Price &
Cosgrove,
1990

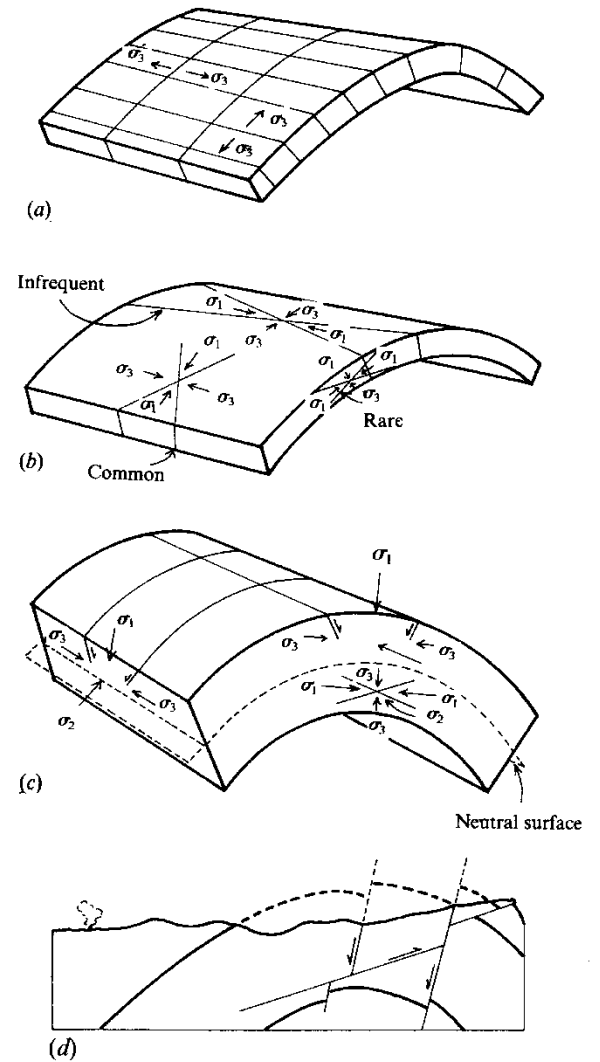
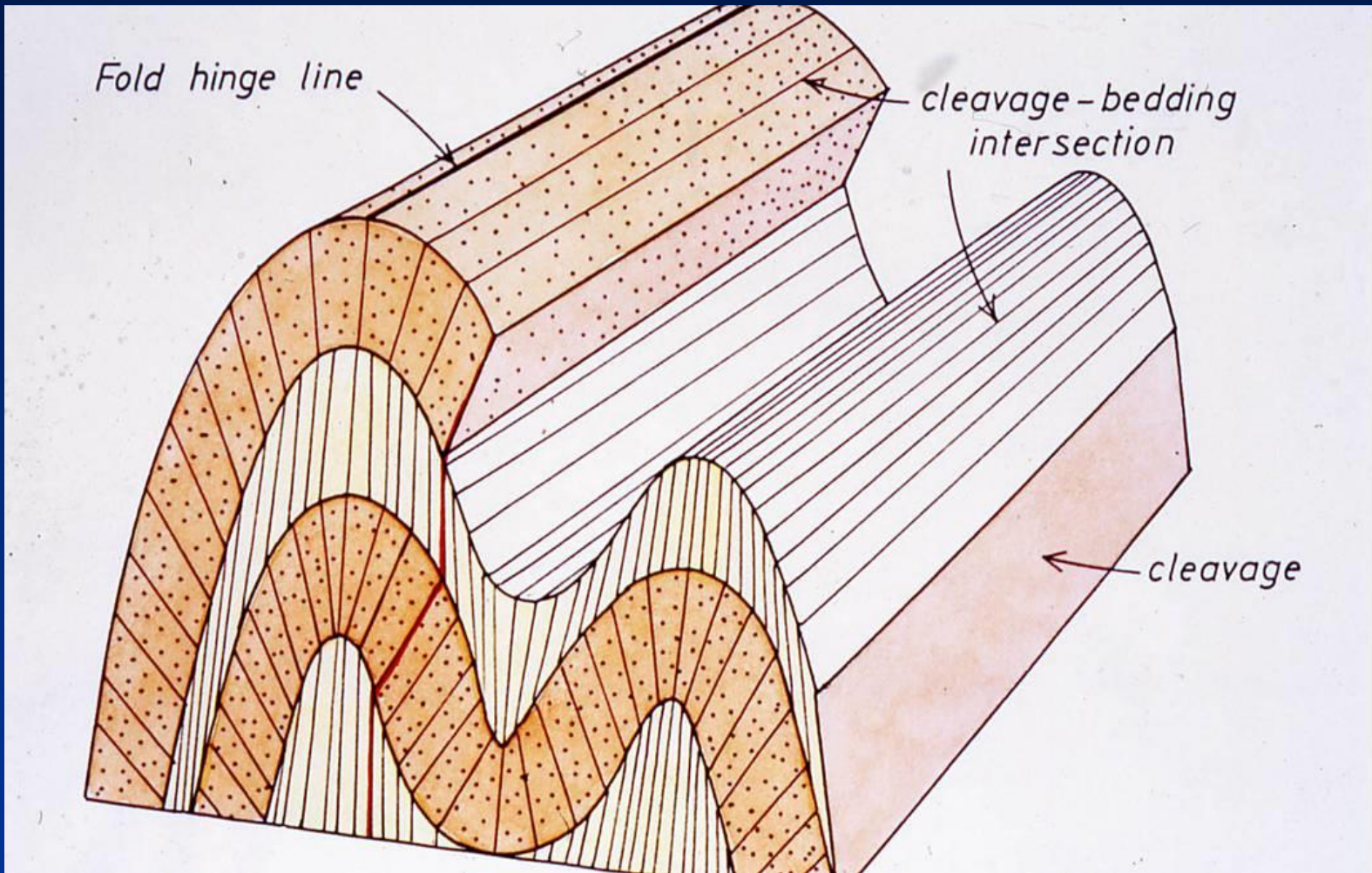


Fig. 14.21. (a) Typical relationship of dilational fractures to a fold. The orientation of the least principal stress with the sets (of different ages) is also shown. (b) Typical orientation of shear fractures in a thin, bedded layer, with associated stress systems. (c) Typical orientation of normal faults and thrusts which may develop in a thick, flexured unit. (See Fig. 14.22 for relationship between shear fractures and stresses.) (d) Interaction of thrusts and normal faults.

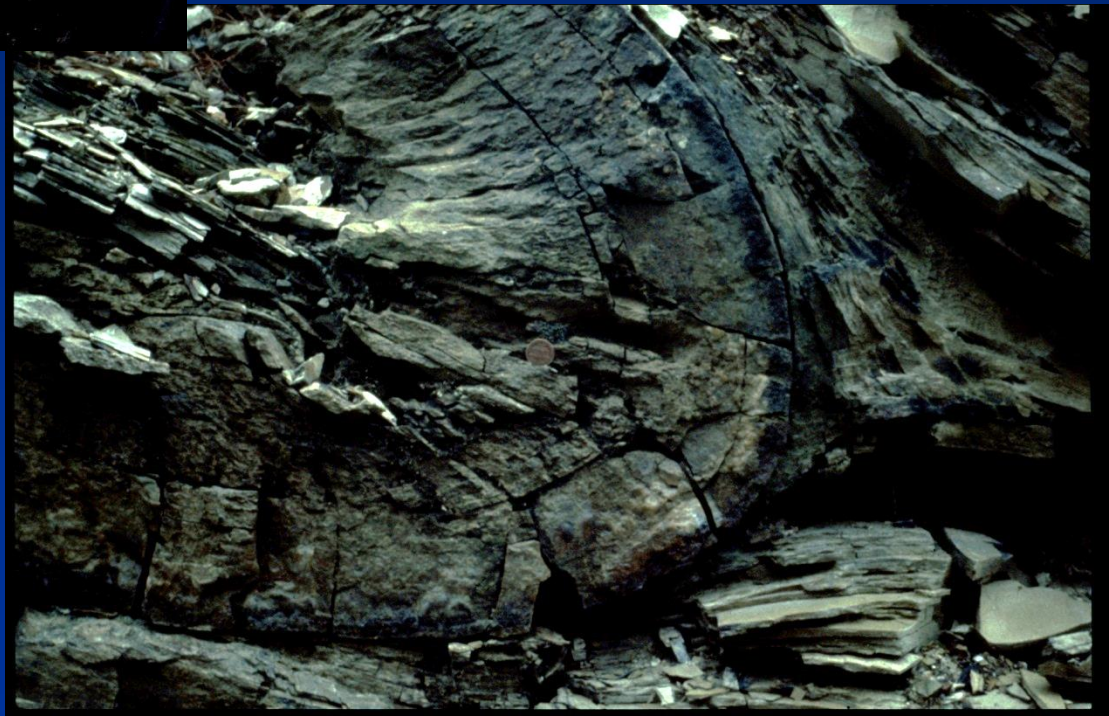


Da Ramsay & Huber, 1987



Da Ramsay & Huber, 1987

Da Ramsay & Huber, 1987



Foliazione di piano assiale: tipica dei regimi duttili e delle pieghe simili



Da Ramsay & Huber, 1987

Pieghe simili

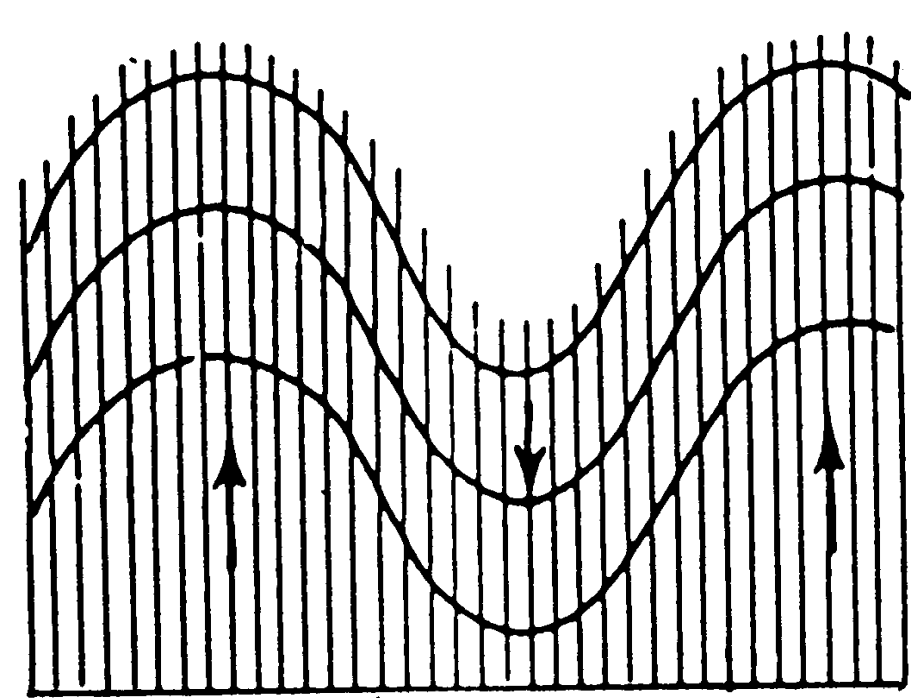
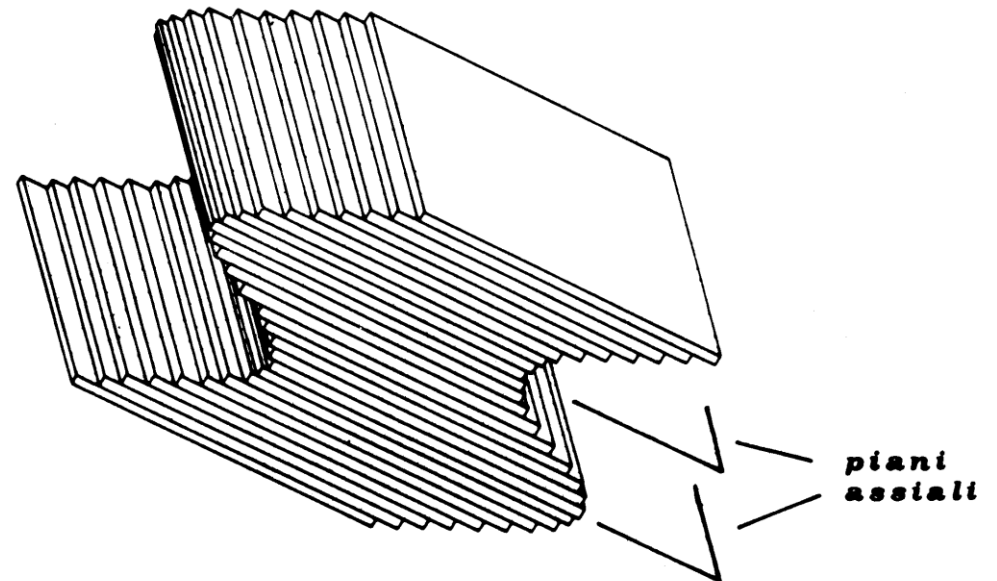


Fig. 68 - Esempio di pieghe simili
(da HILLS, 1963).

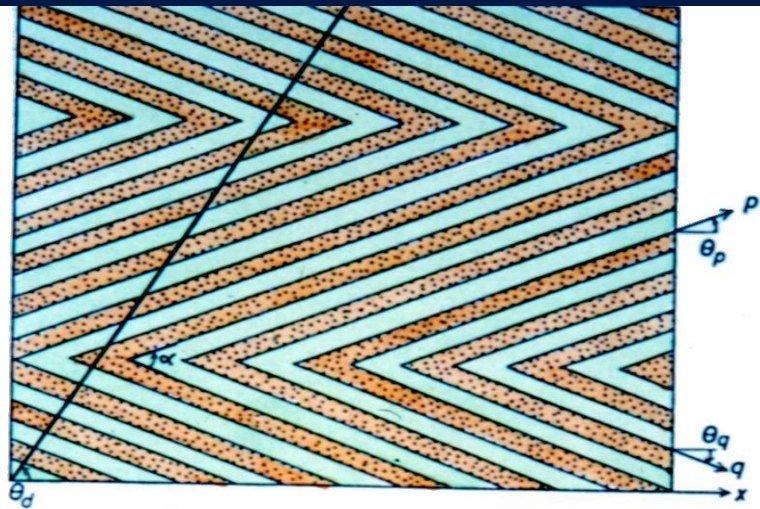
Da Boccaletti & Tortorici, 1987



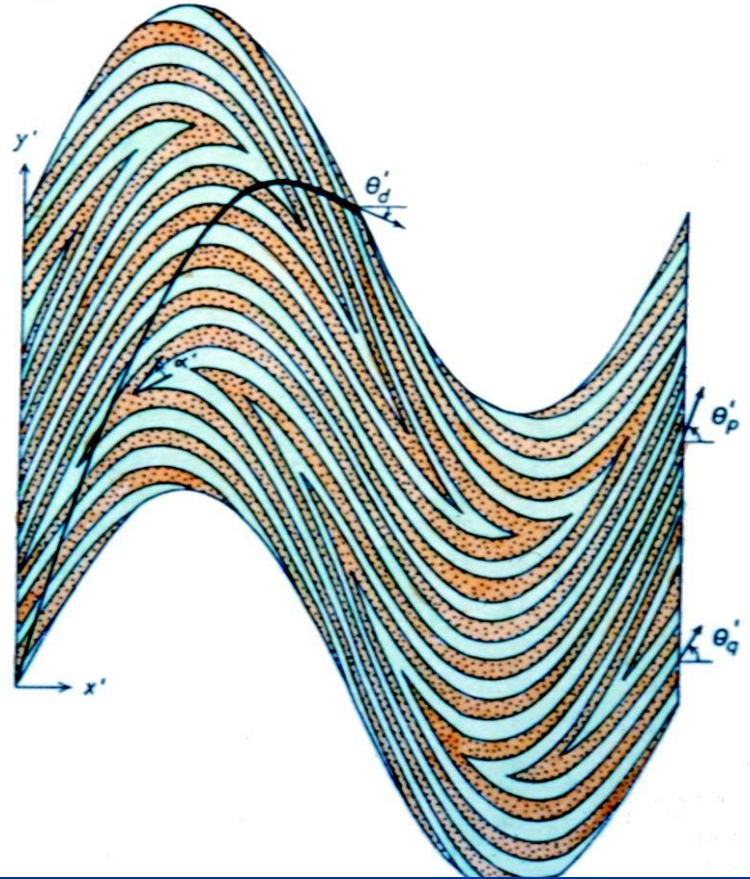
Pieghe ripiegate “strutture di interferenza”



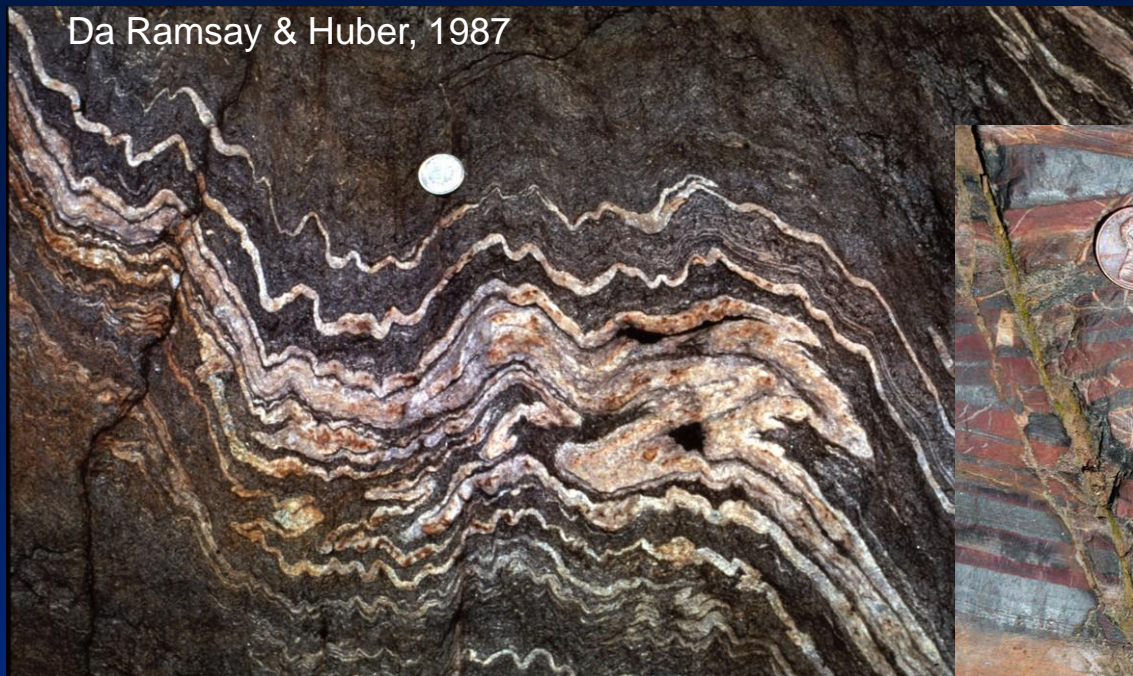
Da Ramsay & Huber, 1987



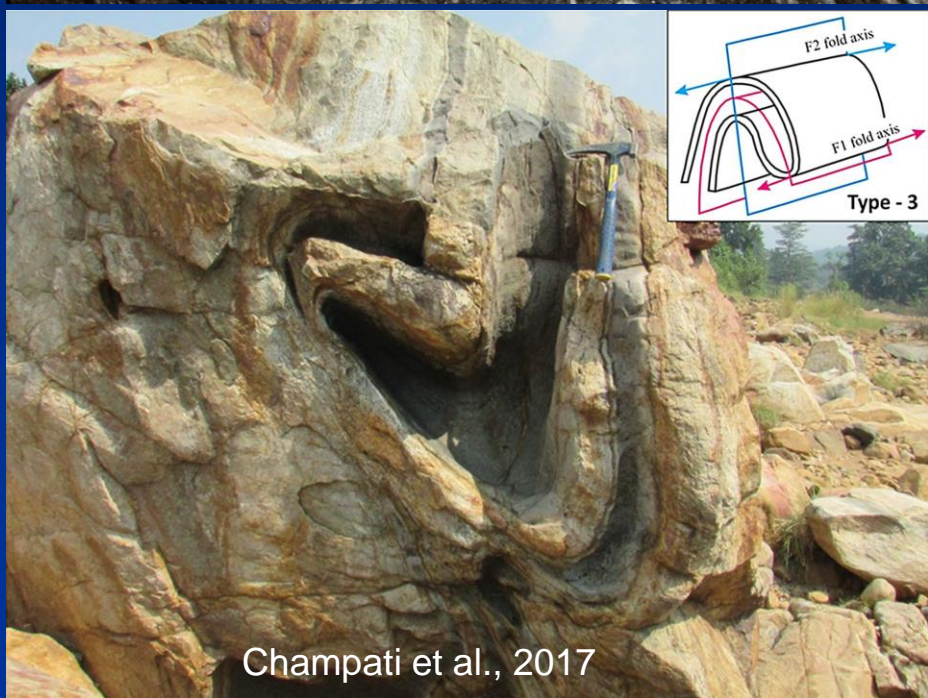
B.



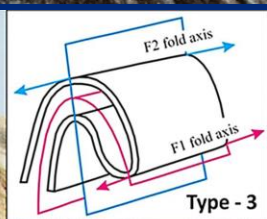
Da Ramsay & Huber, 1987



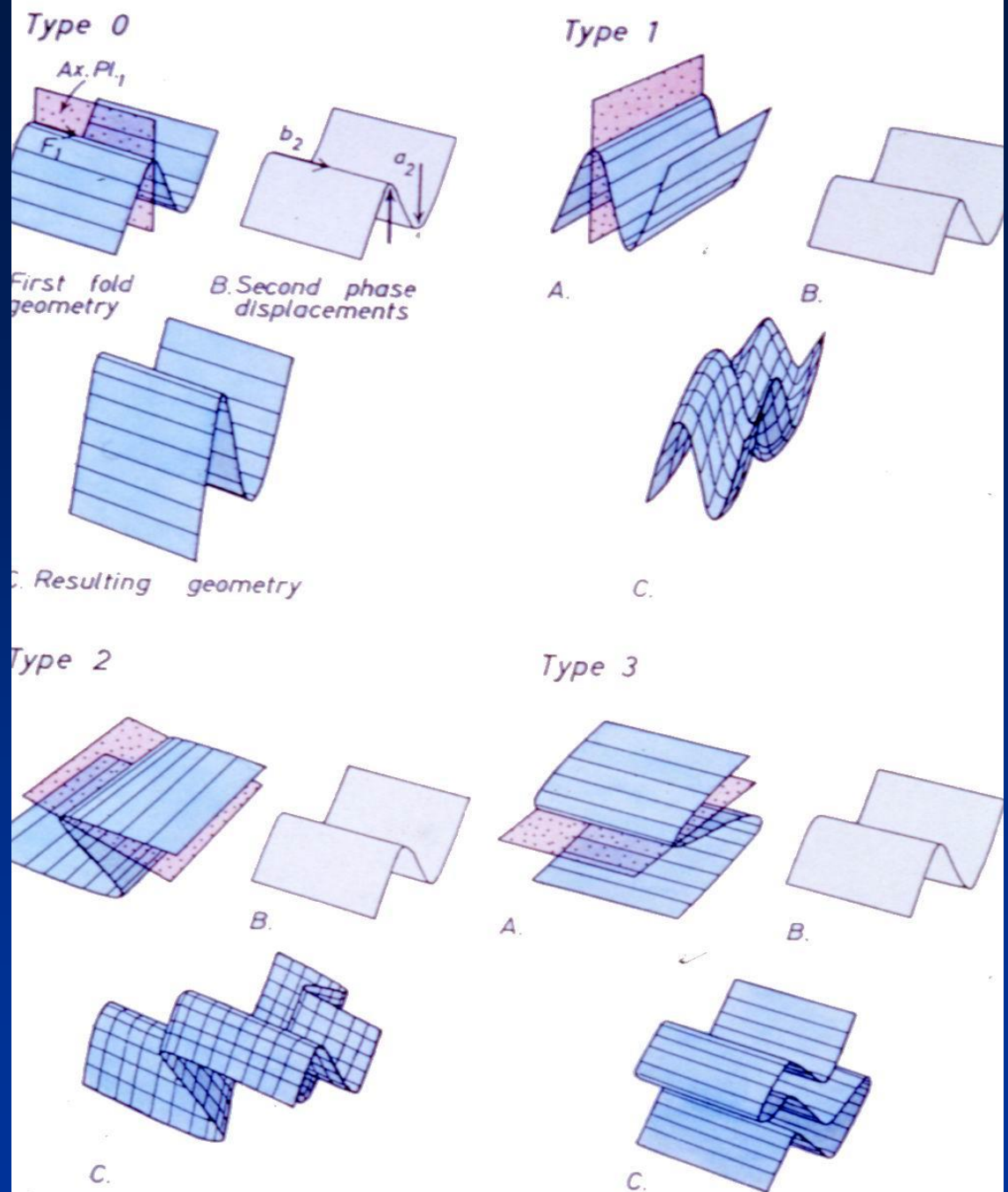
Da Fossen, 2010



Champati et al., 2017



Pieghe ripiegate “strutture di interferenza”





Da Ramsay & Huber, 1987

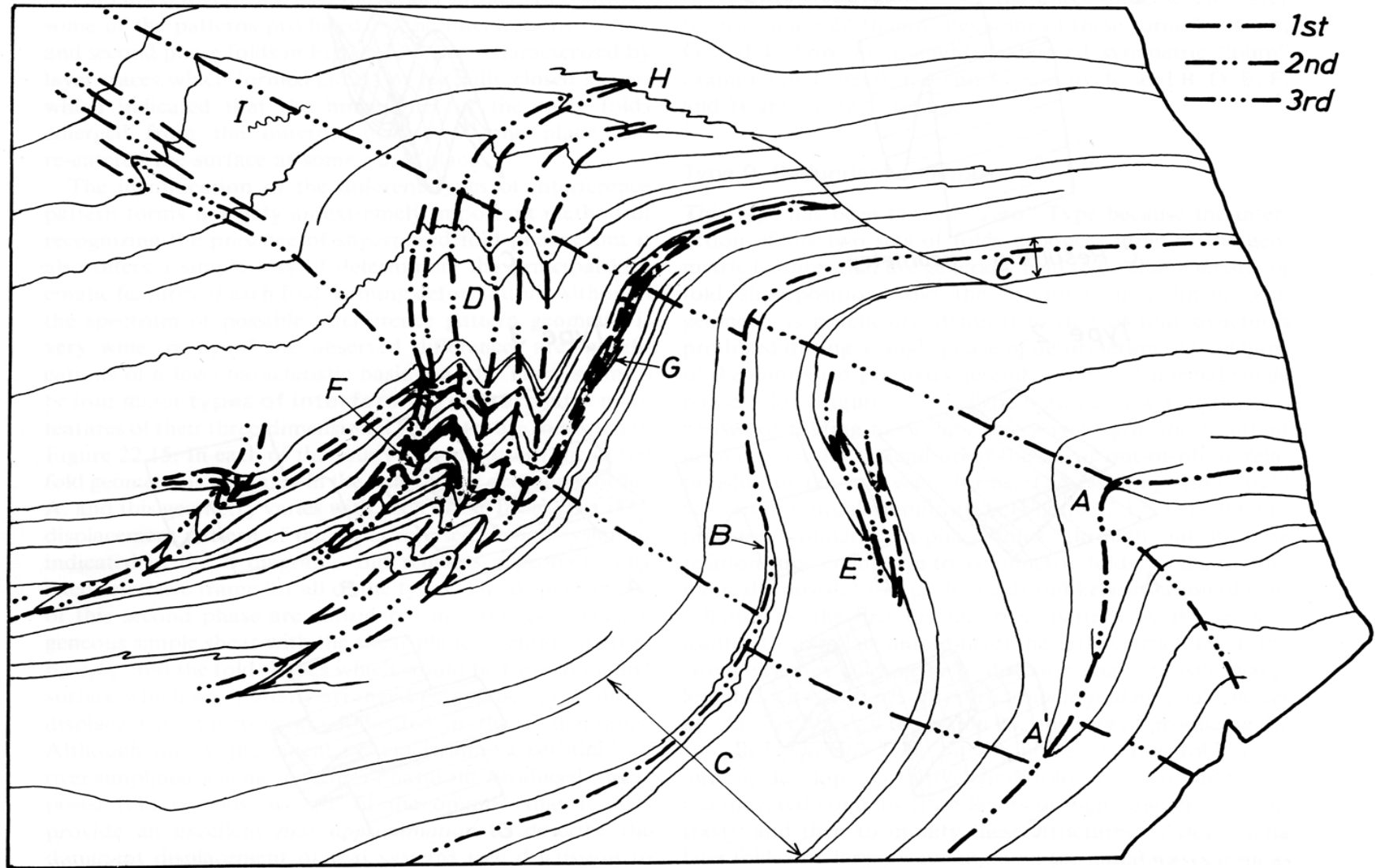


Figure 22.14. Answer 22.4 showing the positions of the axial traces of three sets of folds. For further details see discussion in text.