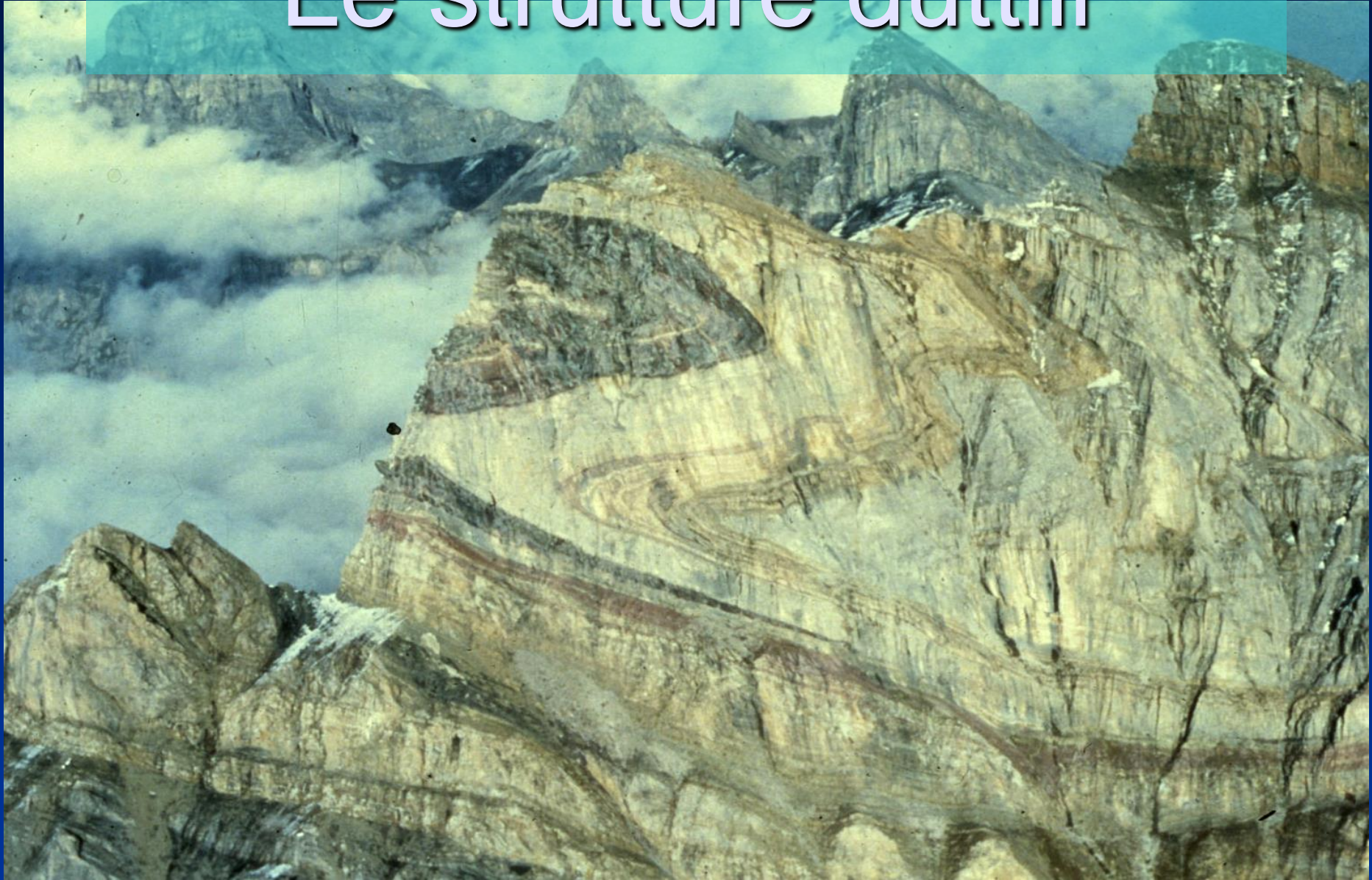


Le strutture duttili



Da Ramsay and Huber, 1987

Immagini e fotografie tratte da:

- Barker A.J., 1990. Introduction to Metamorphic Structures and Microstructures. Chapman & Hall.
- Mercier J., Vergely P., 1996. Tettonica. Pitagora Editore.
- Mercier J., Vergely P., 1995. Tectonique, 2ème edition, Dunod.
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- Pini, materiale inedito.
- Price N.J., Cosgrove J.W., 1990. Analysis of Geological Structures. Cambridge University Press
- Ramsay J.G., 1967. Folding and Fracturing of Rocks. McGraw Hill.
- Ramsay J. G., Huber M. I., 1984. The Techniques of Modern Structural Geology. Volume 1: Strain analysis. Academic Press Inc.
- Ramsay J. G., Huber M. I., 1987. The Techniques of Modern Structural Geology. Volume 2: Folds and Fractures. Academic Press Inc.
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- van der Pluijm B., Marshak S., 2004. Earth Structure: An Introduction to Structural Geology and Tectonics, Second Edition. WW Norton & Company.



Da Ramsay and Huber, 1987

Le strutture duttili

CARATTERISTICHE:

- 1) Deformazione continua
- 2) Comportamento duttile della roccia

TIPICI:

- 1) Strutture da deformazione omogenea (*variazione forma oggetti, boudinage*)
- 2) Fabric (*foliazione, scistosità, clivaggio da crenulazione, lineazioni*)
- 3) Strutture da deformazione disomogenea (eterogenea) (*interazioni oggetti-matrice, zone di taglio duttile*)

Deformazione di oggetti

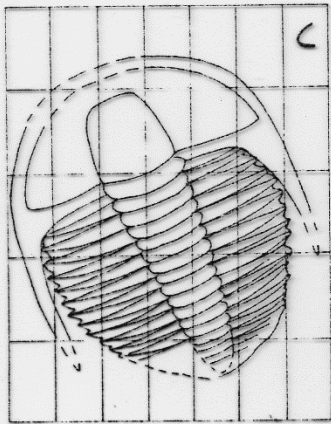


FIG. 3.66
DEFORMAZIONE DI
FOSSILI. C = STATO
INDEFORMATO
DA RAJSAJ E HUBER, 1984

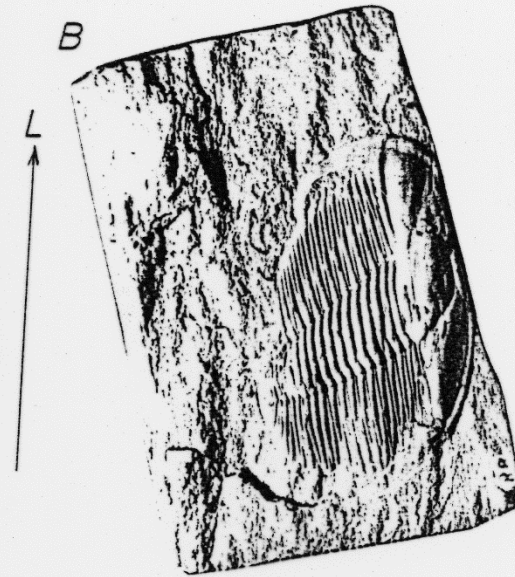
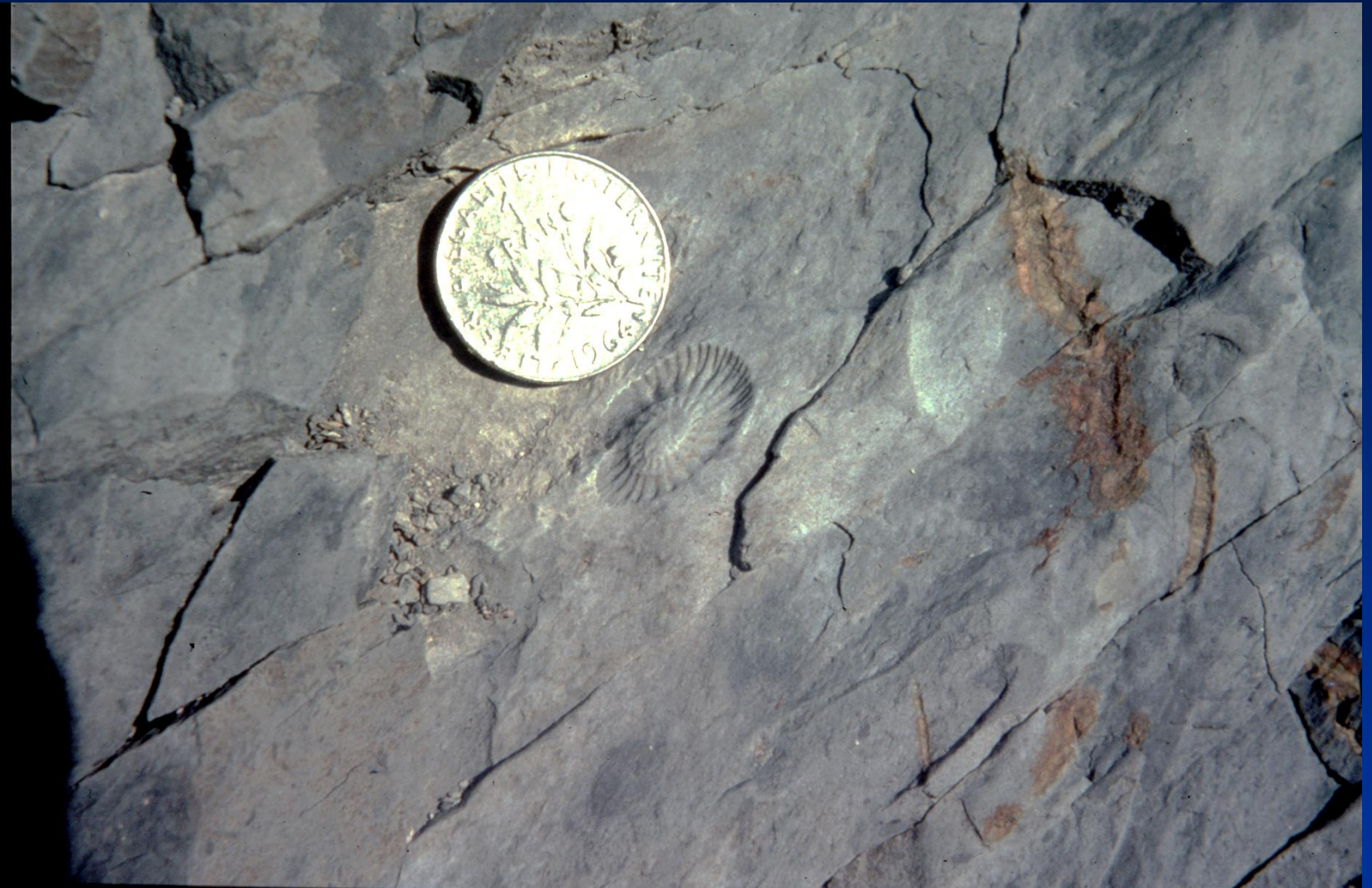


Figure 8.7. Two specimens of Angelina for the determination of principal strain ratio R (Question 8.1). L is the stretching lineation for both specimens.



Da Ramsay and Huber, 1987

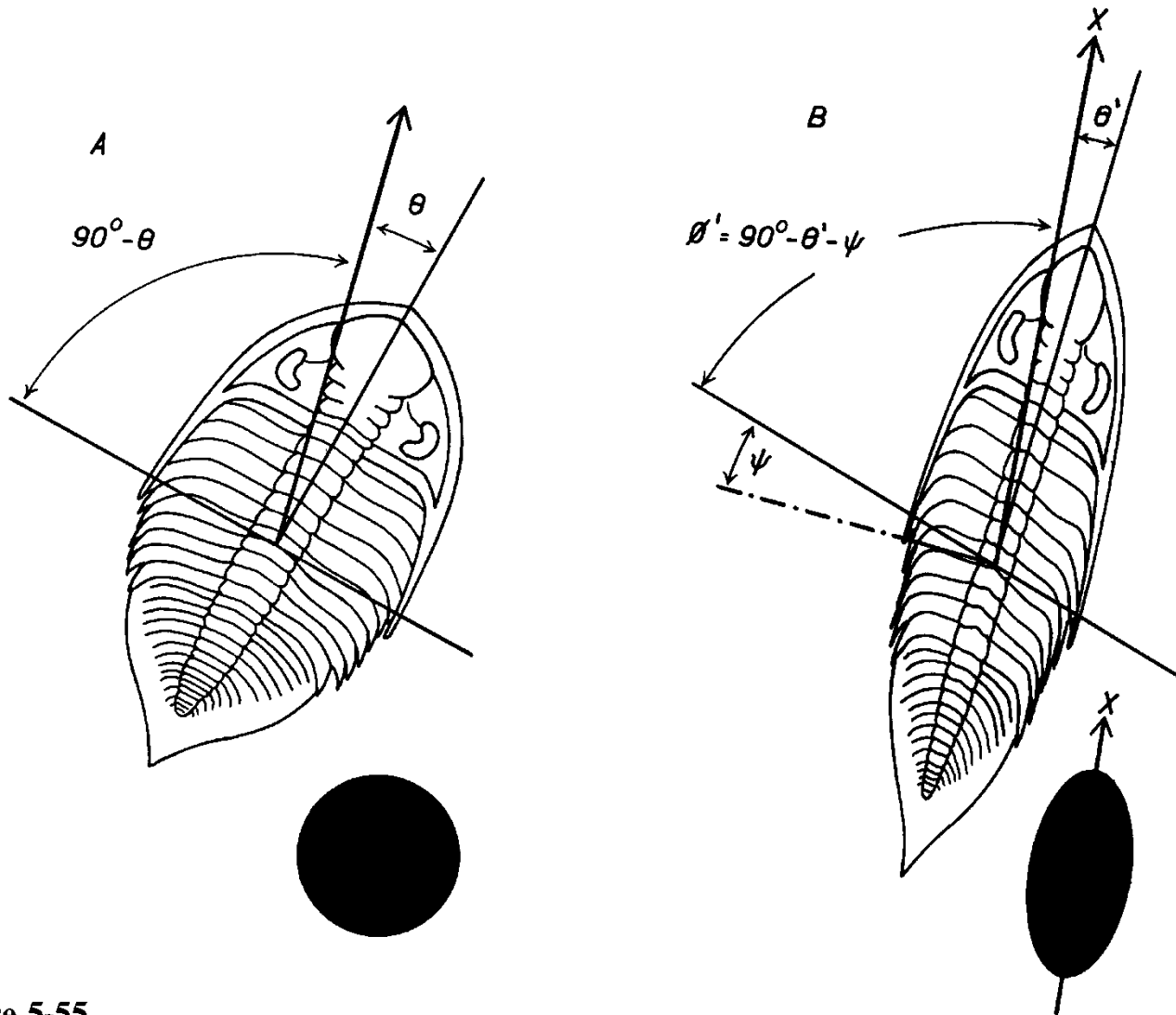


Figure 5-55

Changes in angle within an originally bilaterally symmetric fossil (A) as a result of strain (B). X is the direction of principal extensive strain, and ψ the angular shearing strain.

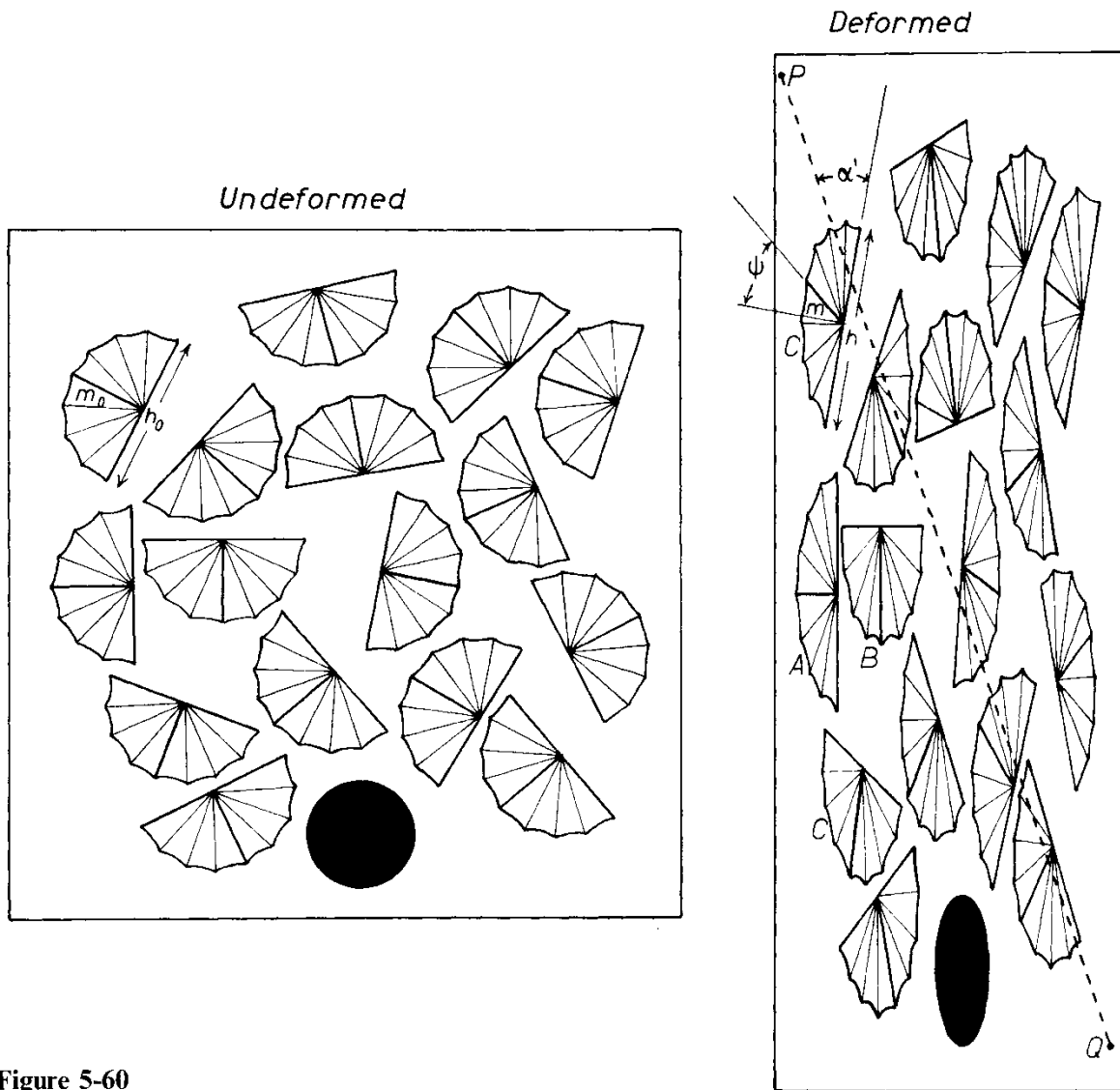
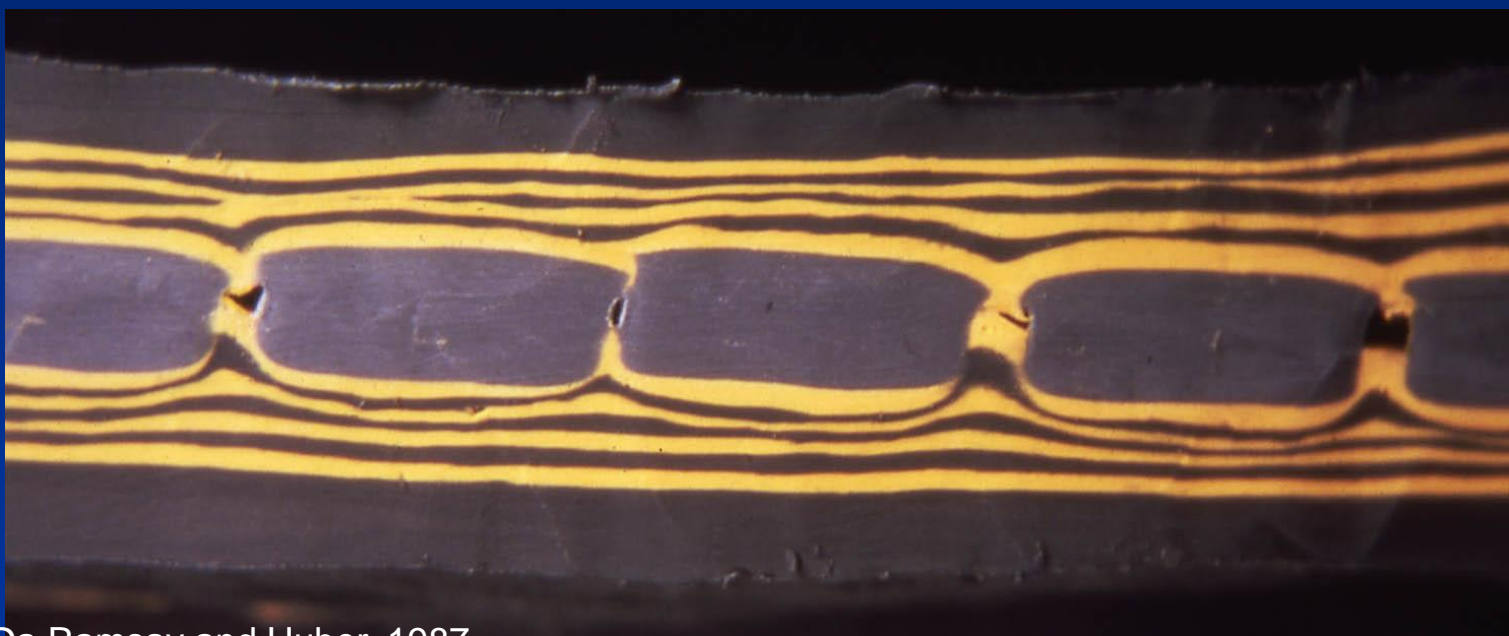


Figure 5-60

The shape changes in an assemblage of equal-sized, bilaterally symmetric fossils as a result of homogeneous strain. A is in the broad form, B the narrow form, and C the oblique form.

Boudinage



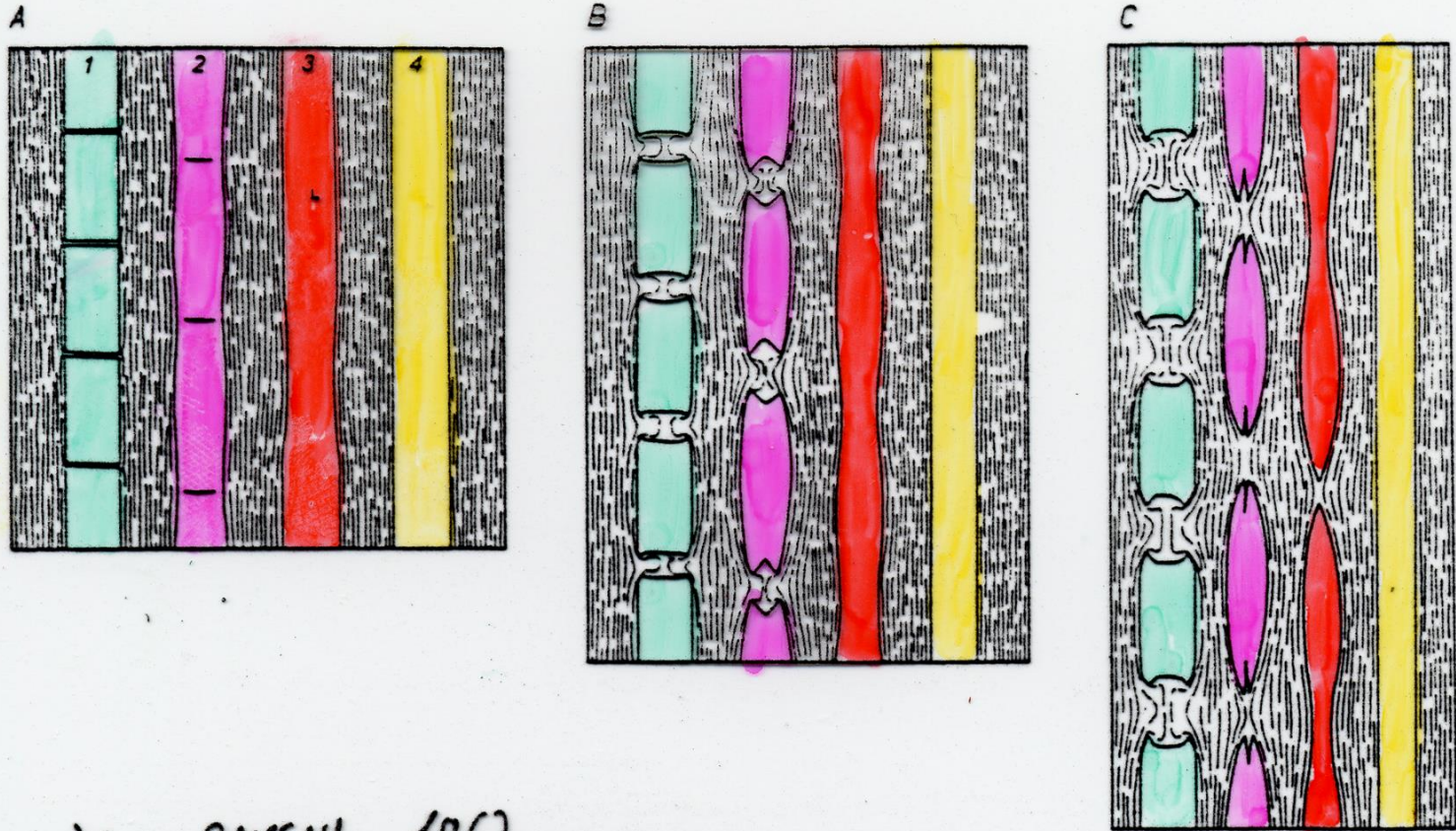


Da Ramsay and Huber, 1987

Da Ramsay and Huber, 1987



Boudinage



DA RAYSA, 1967

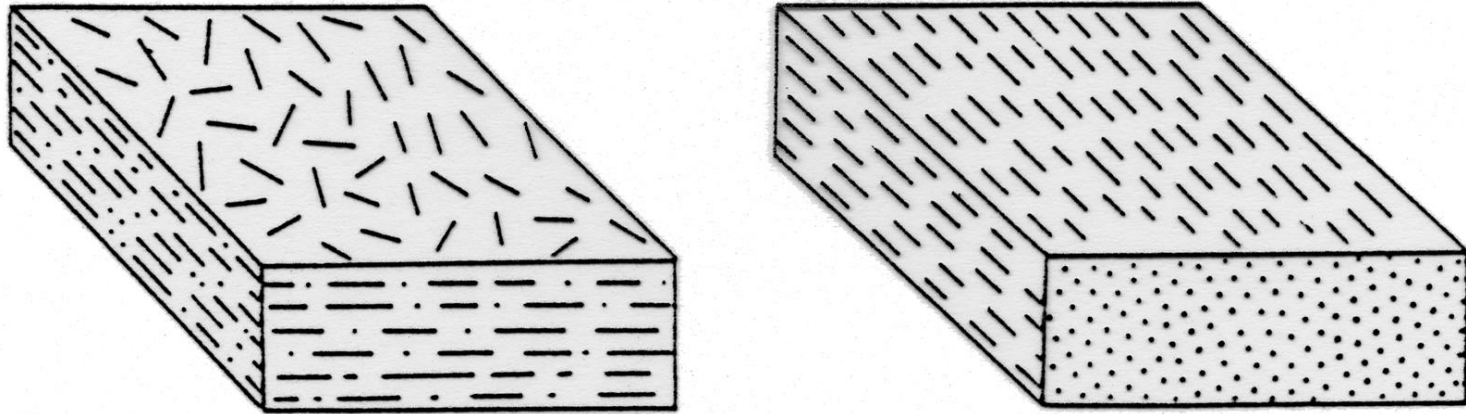


Boudinage asimmetrico

Chocolate boudinage



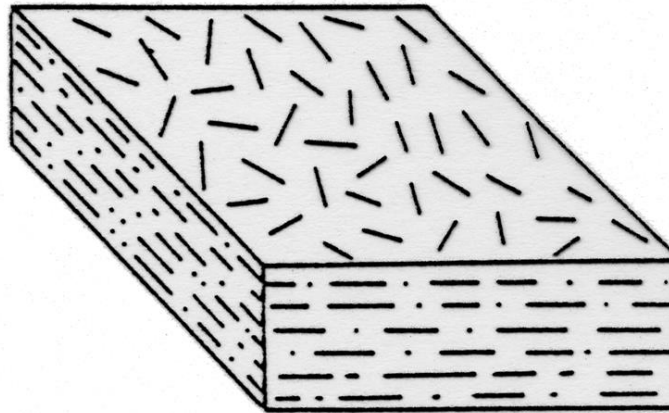
Fabric, foliazione, lineazione



Schematic block diagrams to illustrate the difference between S-tectonites (a) with a pronounced foliation (planar texture), and L-tectonites (b) with a pronounced lineation (linear texture). Metamorphic rocks such as schists and mylonites are generally L-S-tectonites, and have both a linear and planar component.

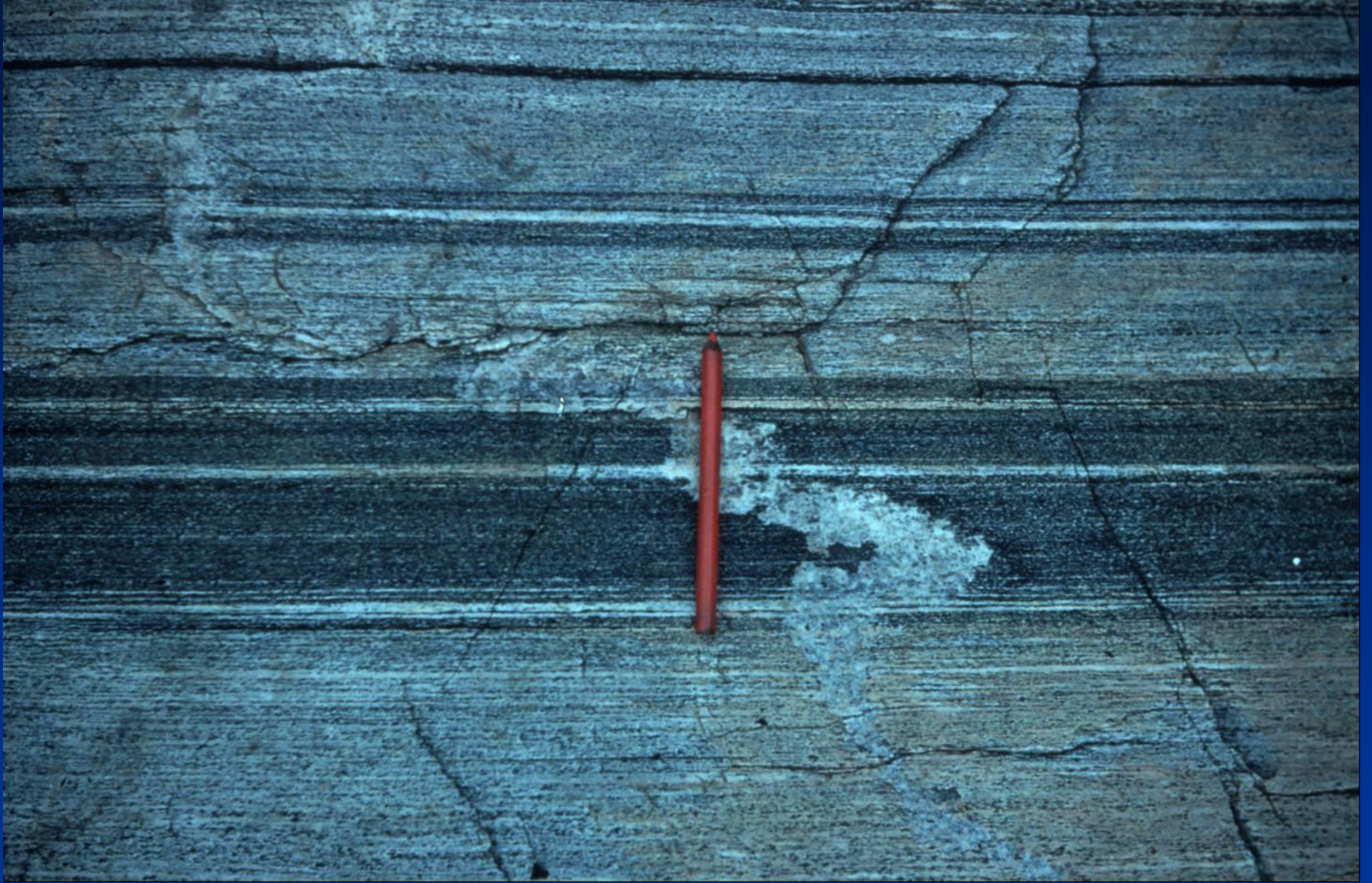
Da Barker, 1990

Fabric, foliazione



Schematic block diagrams to illustrate pronounced foliation (planar texture), and L-tectonic texture). Metamorphic rocks such as schists and gneisses exhibit both a linear and planar component.

Da Barker, 1990

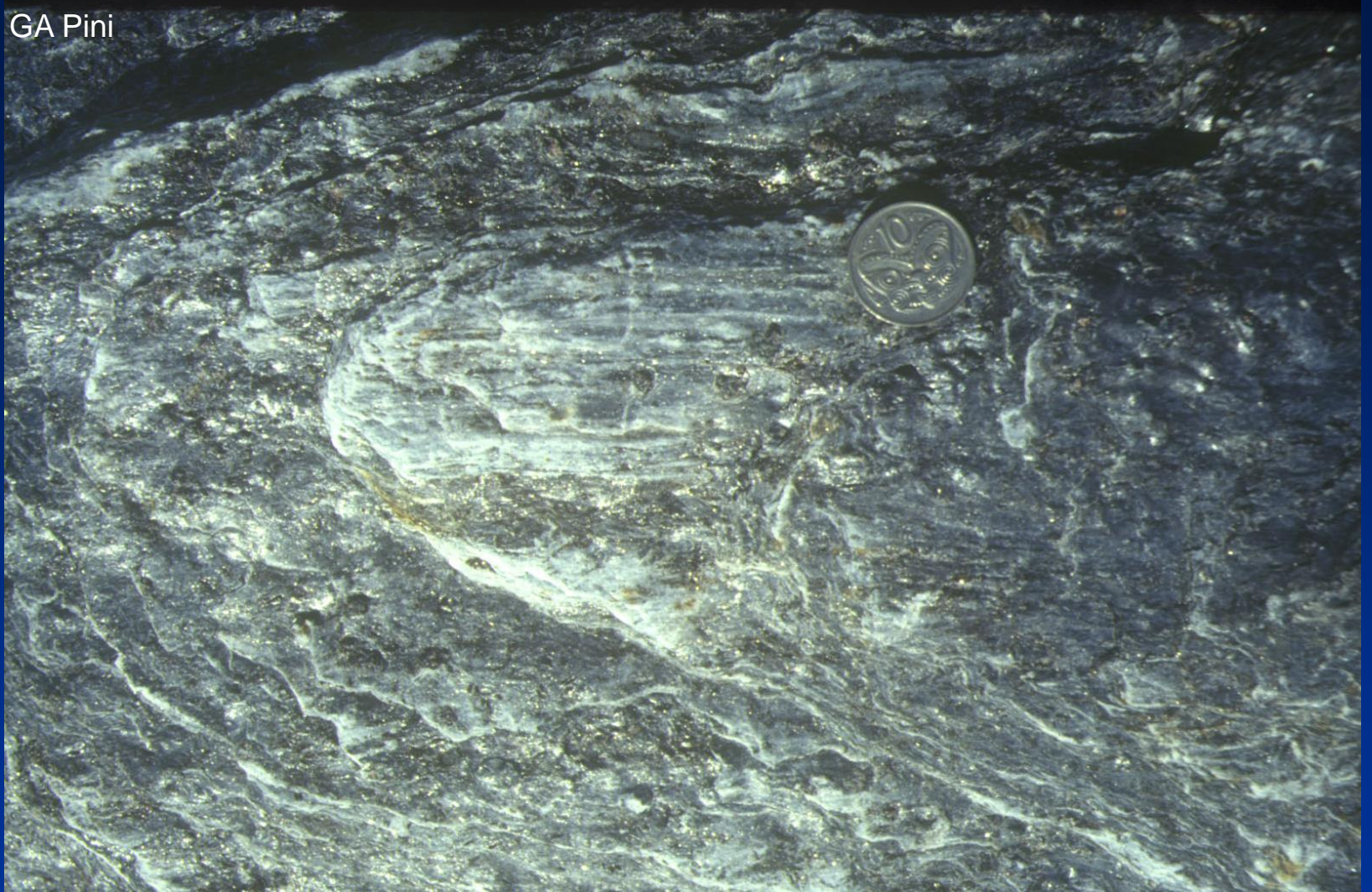


Da Ramsay & Huber, 1987

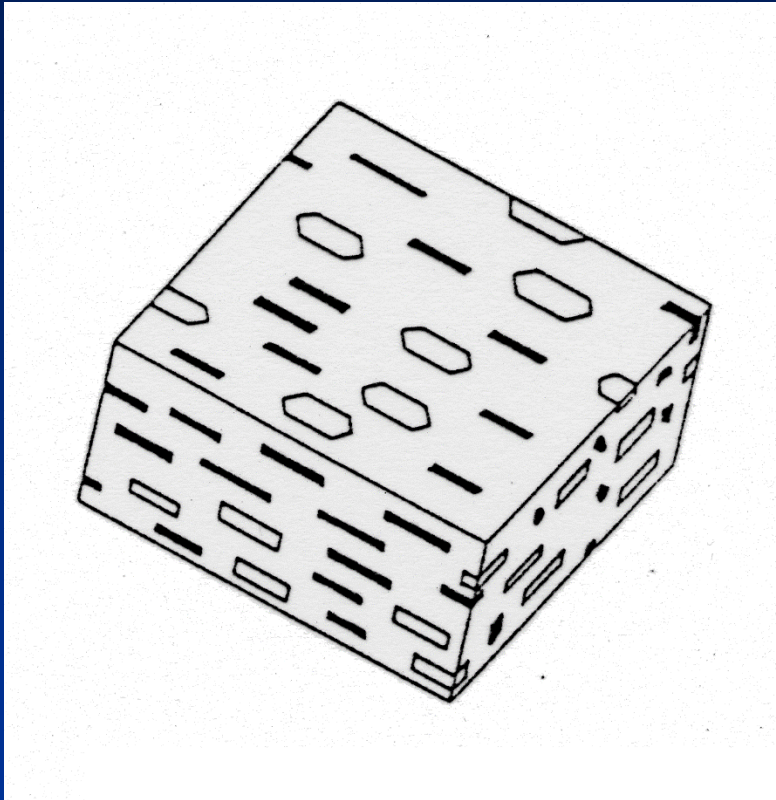
GA Pini



GA Pini



Foliazione+lineazione (S-L)



Da Nicolas, 1984

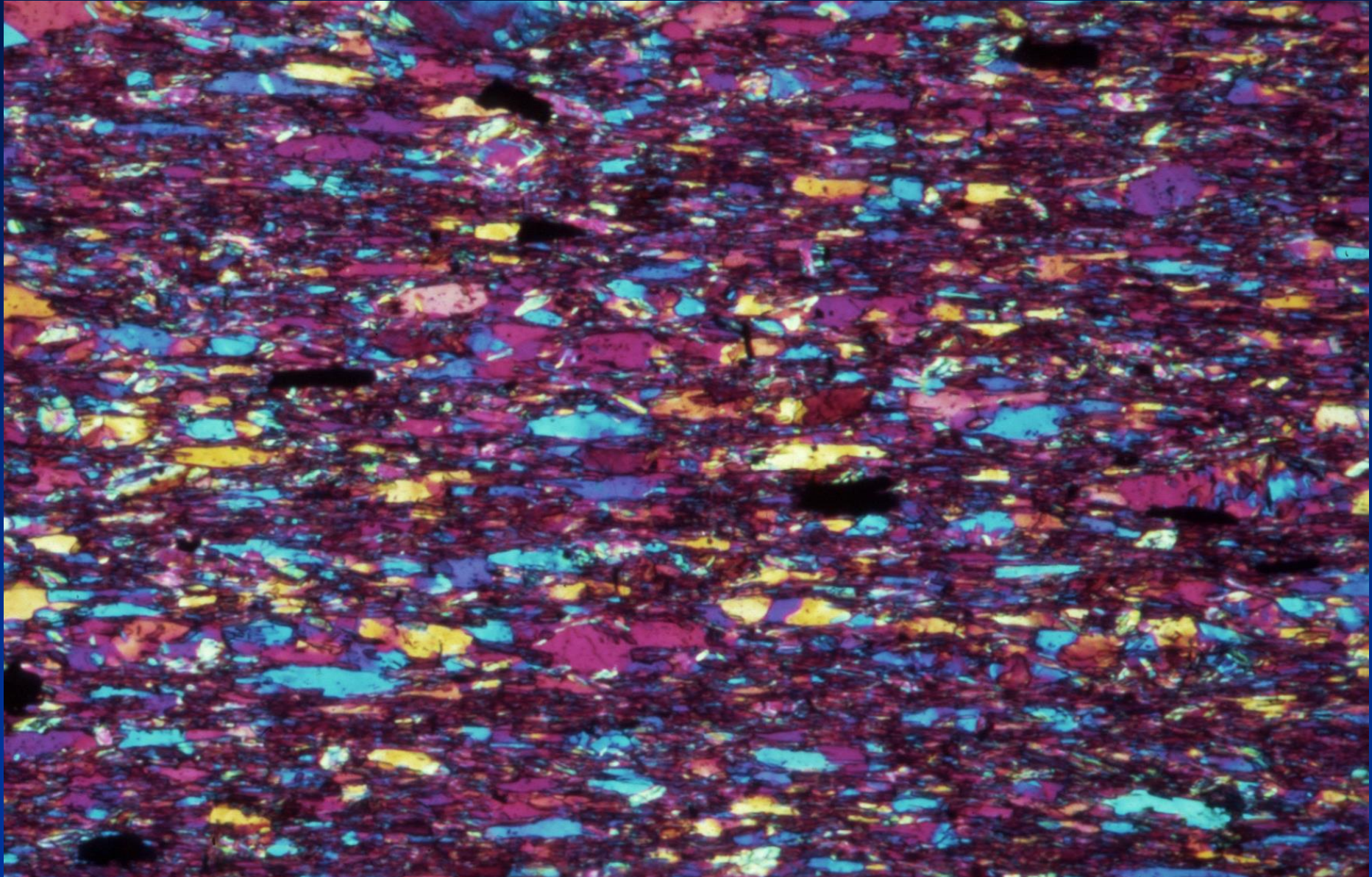


Da Ramsay & Huber, 1984

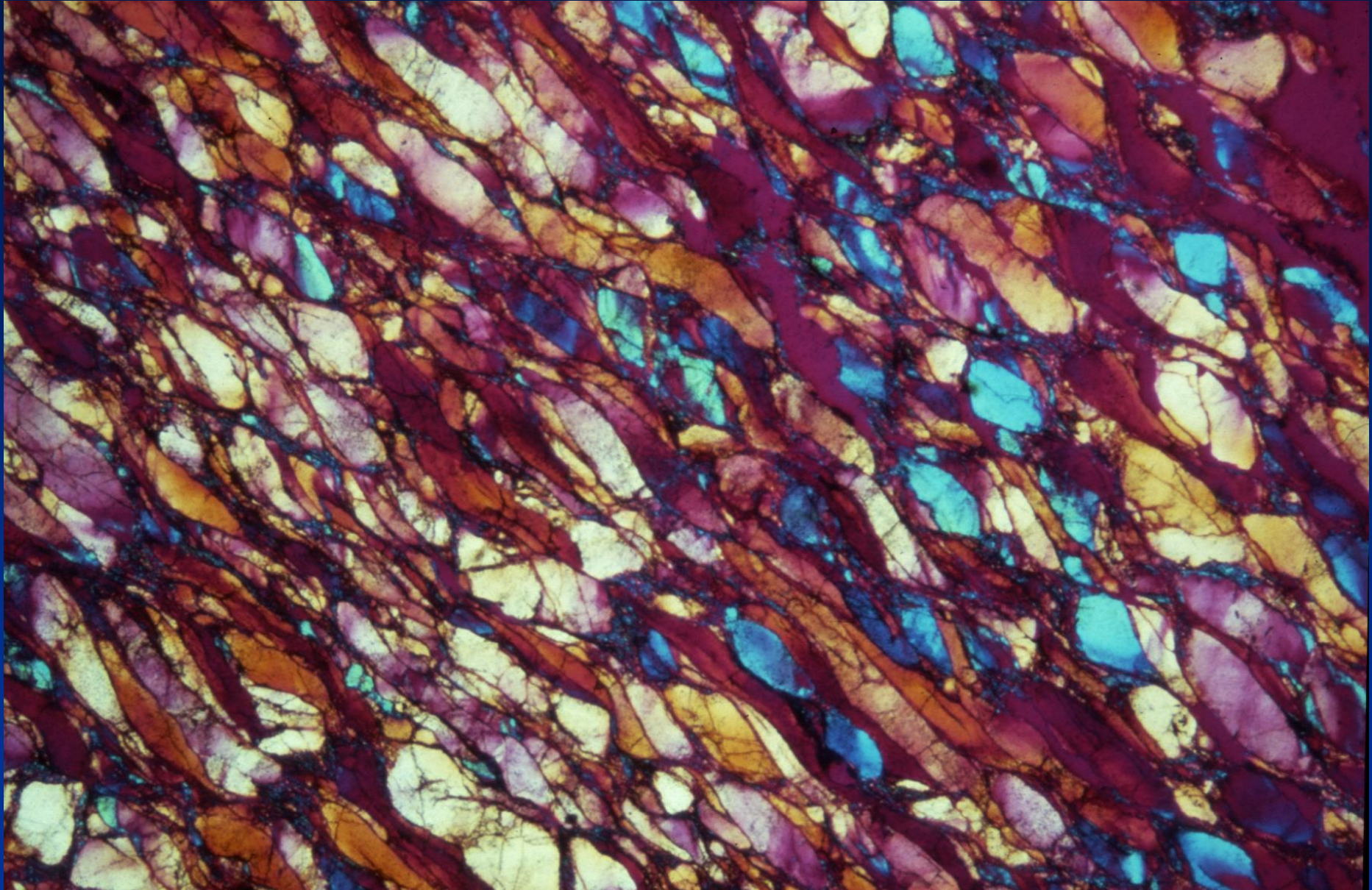


Da Ramsay & Huber, 1984

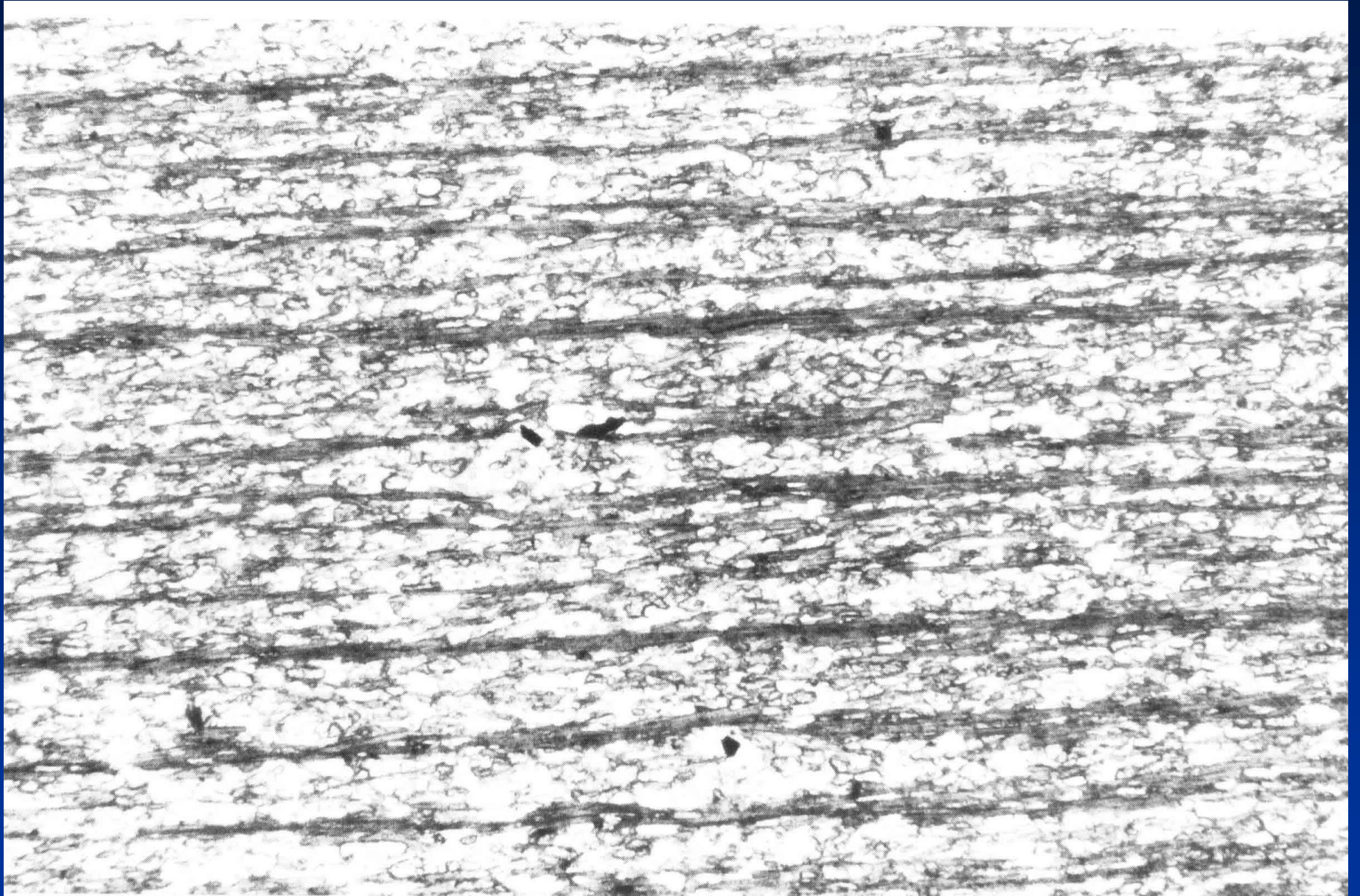
Slaty cleavage



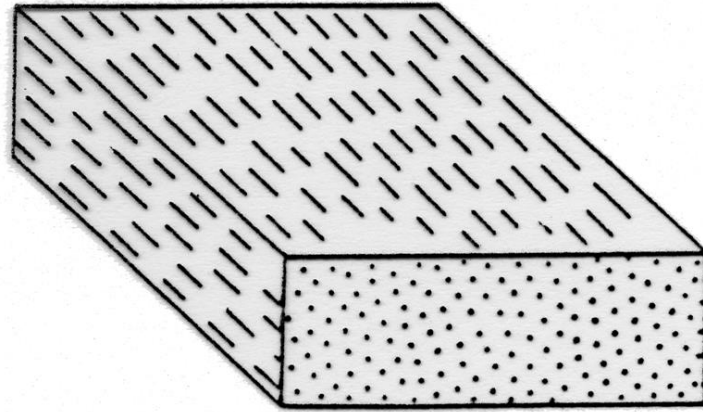
Gneis foliation (o scistosità)



Cleavage domains e microlithons



Fabric, lineazione

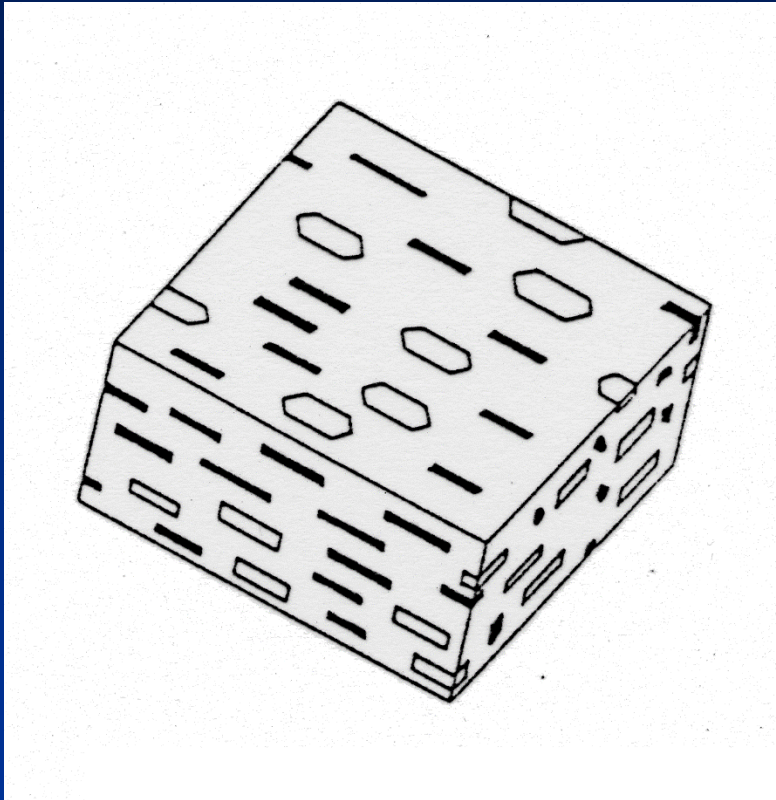


strate the difference between S-tectonites (a) with a
-tectonites (b) with a pronounced lineation (linear
and mylonites are generally L-S-tectonites, and have

Lineazioni



Foliazione+lineazione (S-L)

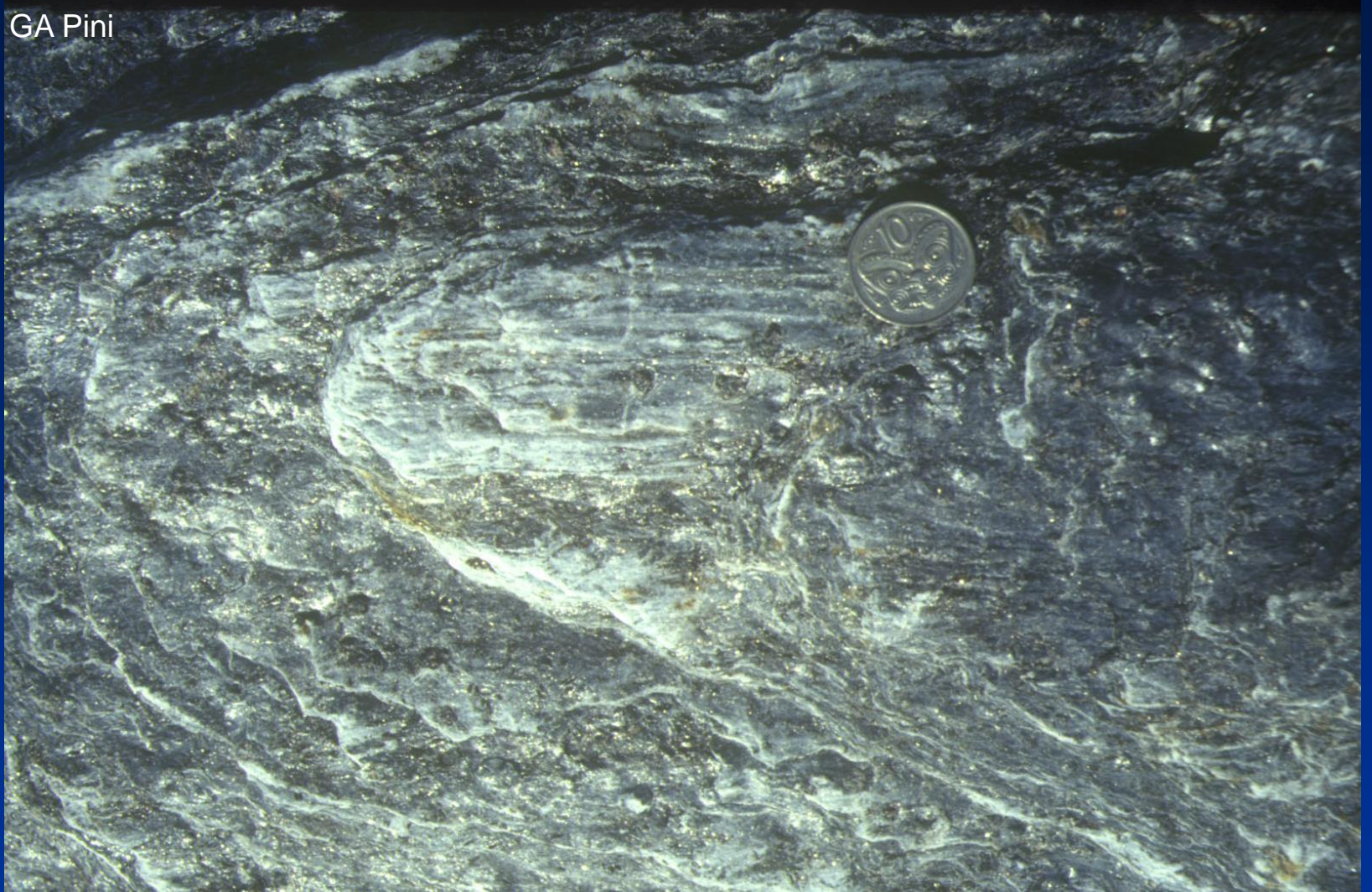


Da Nicolas, 1984

GA Pini

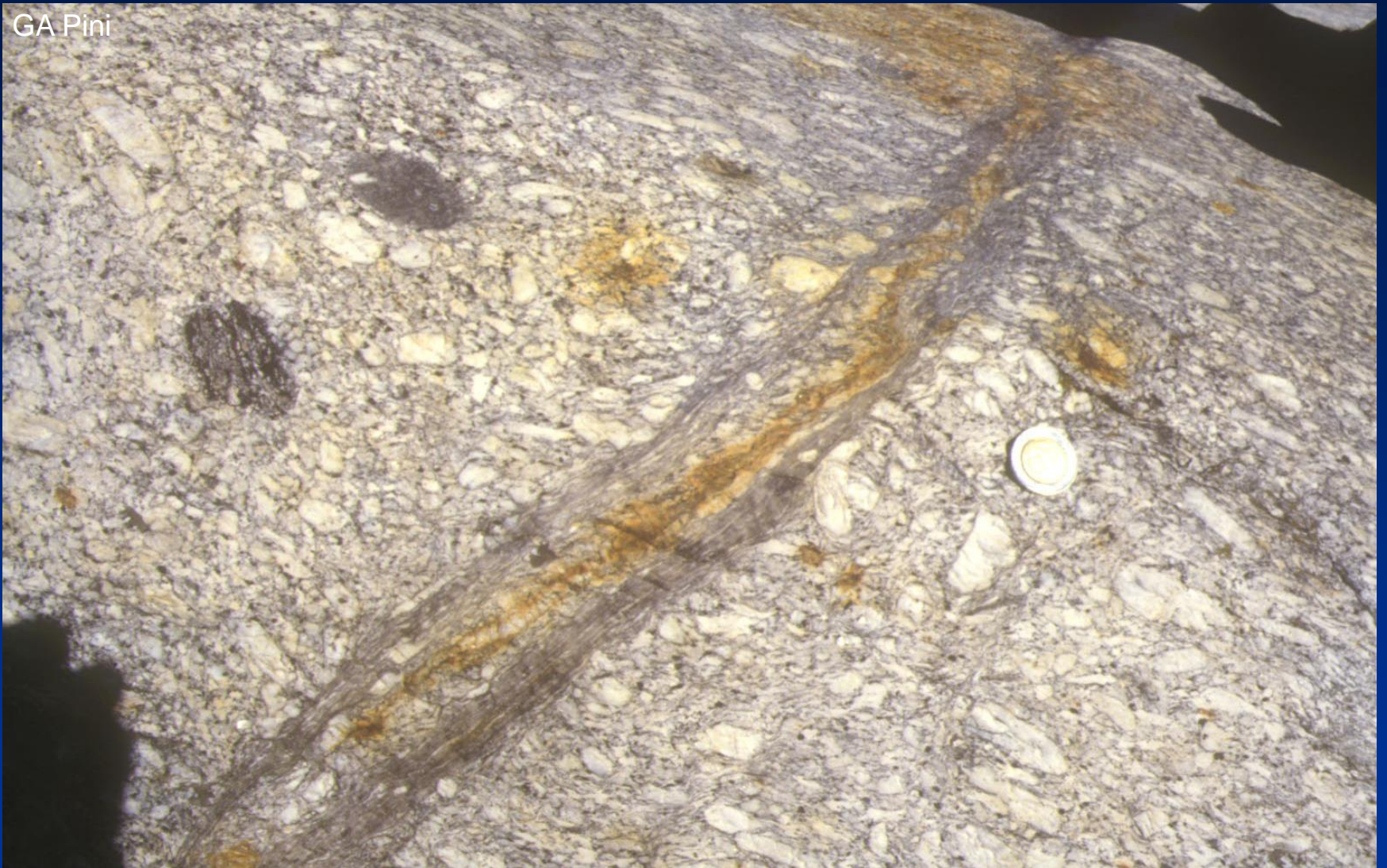


GA Pini



Strutture da deformazione disomogenea

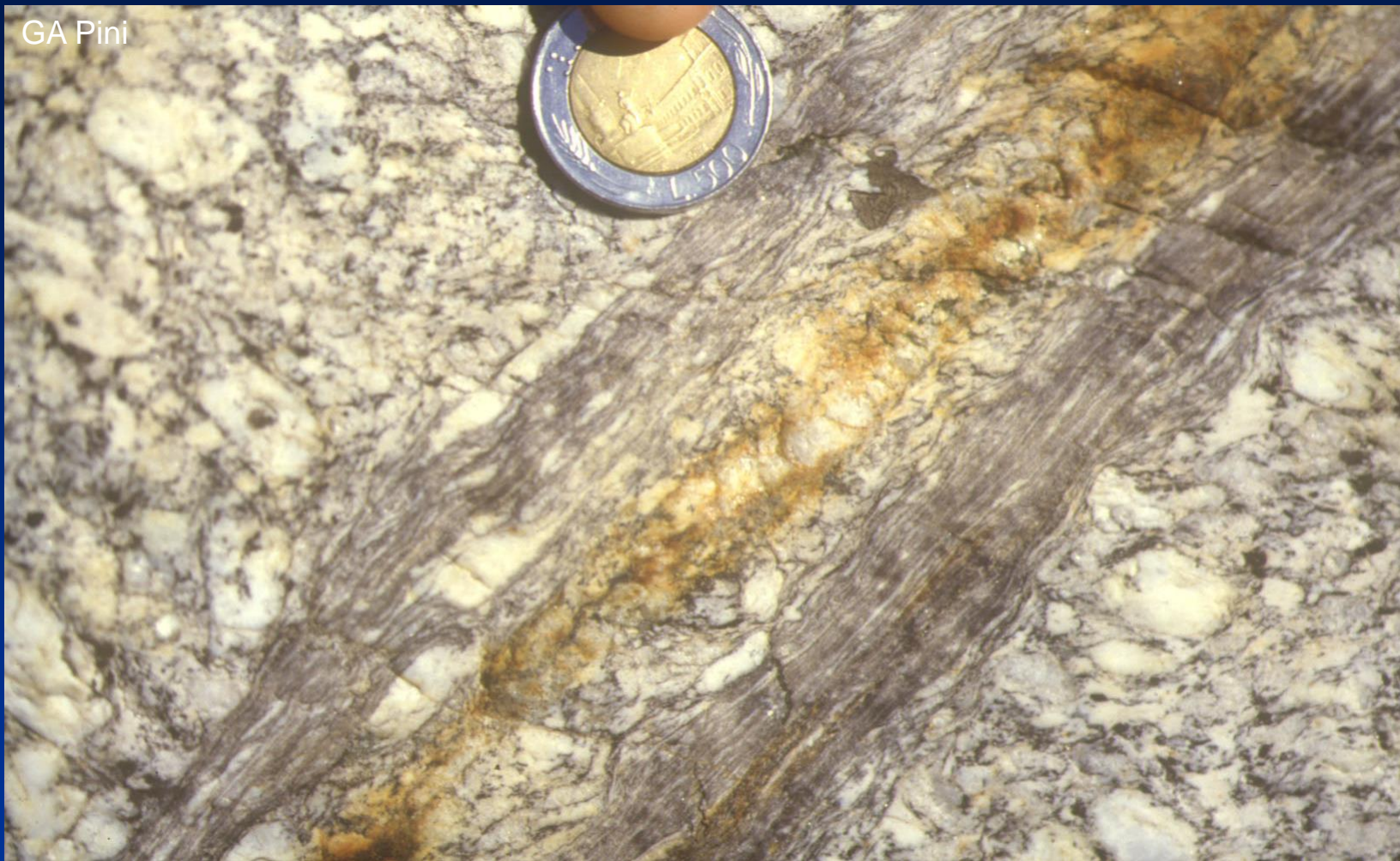
GA Pini



GA Pini

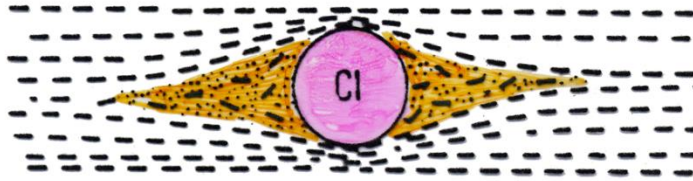


GA Pini

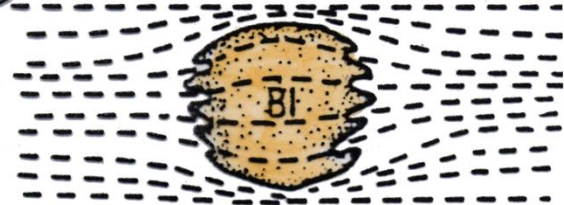


Strutture da deformazione disomogenea

1 OMBRE DE PRESSION



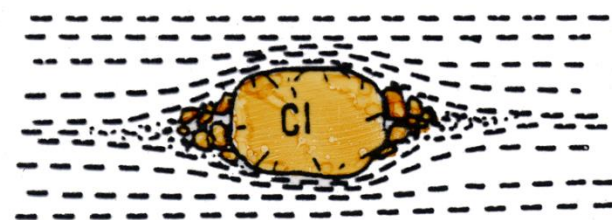
4 INCLUSIONS ORIENTEES



2 FRANGE DE PRESSION



5 DEBRIS DE MINERAUX



3 QUEUE



The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every sale, purchase, and payment must be properly documented to ensure the integrity of the financial statements. This includes recording the date, amount, and purpose of each transaction.

The second part of the document outlines the various methods used to collect and analyze financial data. It describes how data is gathered from different sources, such as sales invoices, bank statements, and internal reports. The analysis involves comparing current performance against historical trends and industry benchmarks to identify areas of strength and weakness.

The third part of the document focuses on the preparation of financial statements. It details the process of calculating key metrics such as revenue, expenses, and profit. It also discusses the importance of presenting this information in a clear and concise manner, using standardized formats and terminology.

The fourth part of the document addresses the role of financial statements in decision-making. It explains how management uses this information to evaluate the company's financial health and to make strategic decisions about investments, financing, and operations. It also highlights the importance of transparency and accountability in financial reporting.

The fifth part of the document discusses the challenges and risks associated with financial reporting. It identifies common pitfalls, such as errors in data collection, misclassification of expenses, and manipulation of figures. It also discusses the importance of internal controls and audits to mitigate these risks and ensure the accuracy of the financial statements.

The sixth part of the document concludes by summarizing the key points discussed and emphasizing the overall importance of financial reporting for the success of any business. It encourages management to maintain a high level of integrity and transparency in all financial transactions and to regularly review and update their financial reporting processes.

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every sale, purchase, and payment must be properly documented to ensure the integrity of the financial statements. This includes keeping receipts, invoices, and bank statements in a secure and organized manner.

The second part of the document provides a detailed overview of the accounting cycle. It outlines the ten steps involved in the process, from identifying the accounting entity to preparing financial statements. Each step is explained in detail, with examples provided to illustrate the concepts. The cycle is presented as a continuous loop that repeats every year.

The third part of the document focuses on the classification of accounts. It explains how to distinguish between assets, liabilities, and equity accounts, and how to further categorize them into current and non-current items. This classification is crucial for preparing the balance sheet and understanding the company's financial position.

The fourth part of the document discusses the recording of transactions. It covers the process of debiting and crediting accounts, and how to ensure that the accounting equation remains balanced. Examples are provided to show how various transactions are recorded in the journal.

The fifth part of the document addresses the adjustment process. It explains why adjustments are necessary and how they affect the financial statements. The document provides a list of common adjustments, such as depreciation, amortization, and accruals, and shows how they are recorded in the journal.

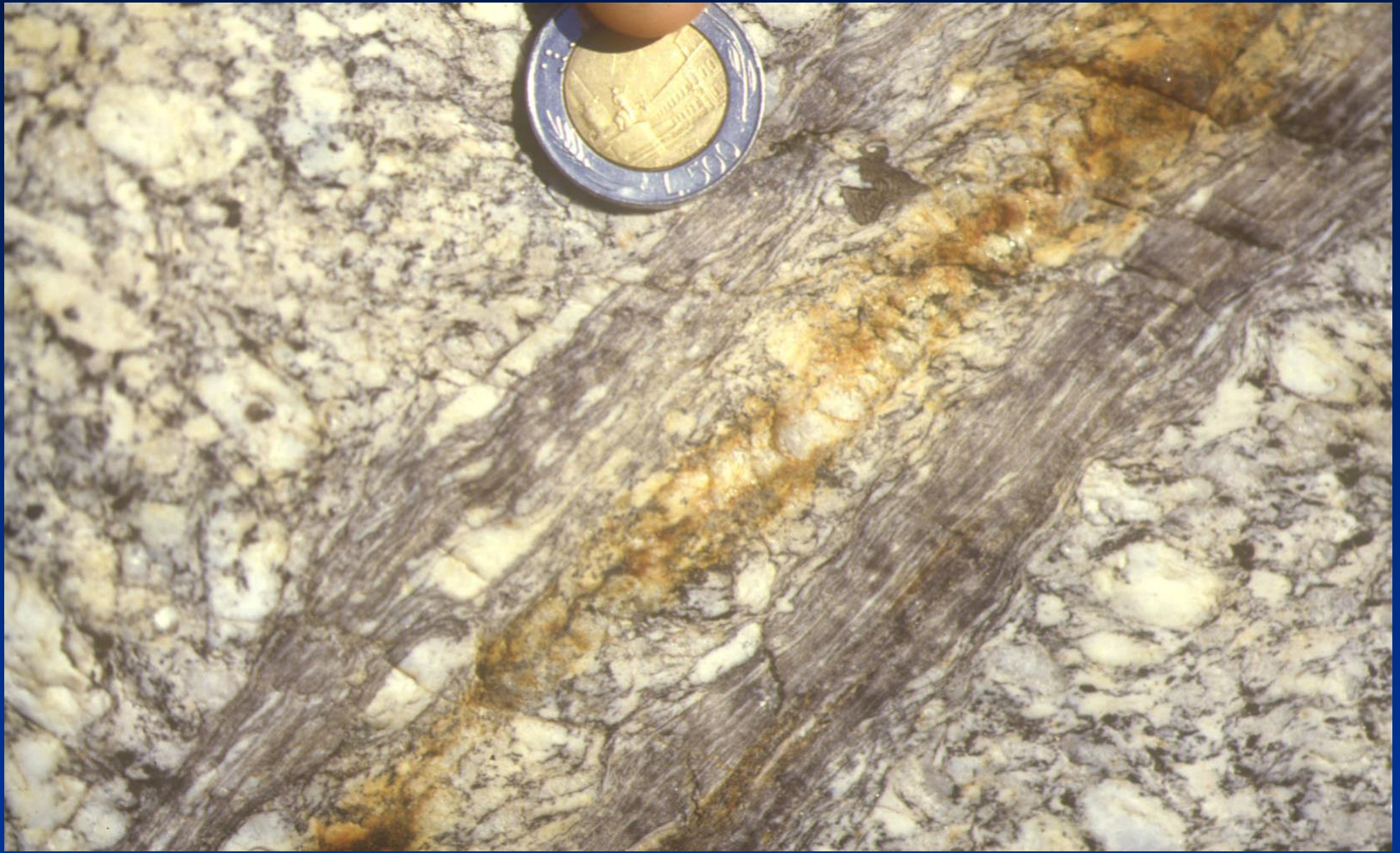
The sixth part of the document discusses the preparation of financial statements. It outlines the steps involved in calculating net income, preparing the income statement, and determining the ending balances for the balance sheet and equity accounts. The document provides a template for each statement and shows how the data is derived from the journal.

The seventh part of the document covers the closing process. It explains how to close the temporary accounts (revenues, expenses, and dividends) to the permanent accounts (retained earnings and equity). This process resets the temporary accounts for the next accounting period and updates the equity accounts.

The eighth part of the document discusses the importance of internal controls. It explains how to design and implement controls to prevent errors and fraud, and how to monitor the effectiveness of these controls. The document provides a list of common internal controls and explains how they are applied in practice.

The ninth part of the document discusses the role of the auditor. It explains the responsibilities of the auditor and the types of audits that can be performed. The document provides a list of common audit procedures and explains how they are used to verify the accuracy of the financial statements.

The tenth part of the document discusses the importance of ethics in accounting. It explains the ethical standards that accountants must follow and how to handle ethical dilemmas. The document provides a list of common ethical dilemmas and explains how they are resolved.



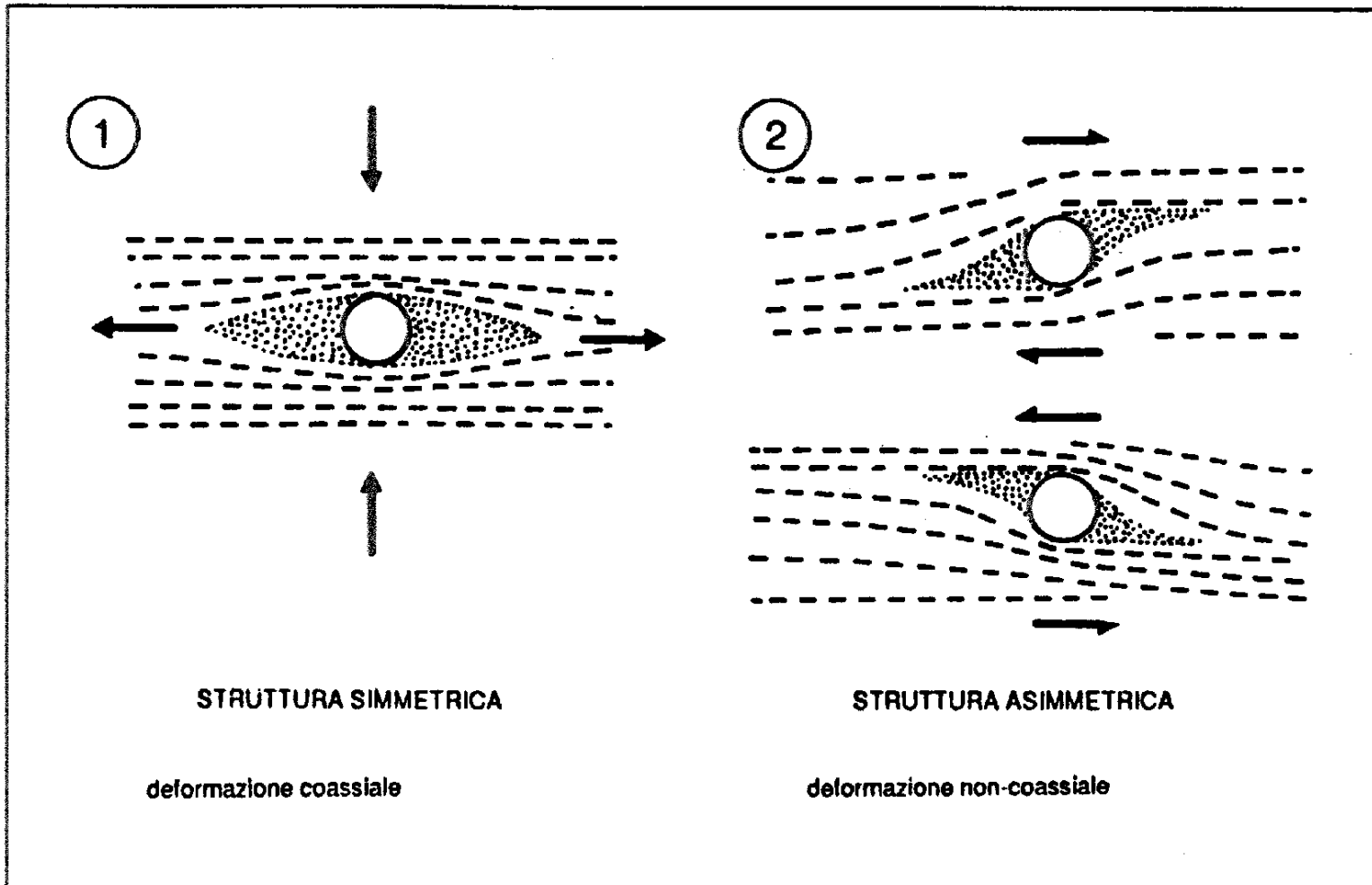
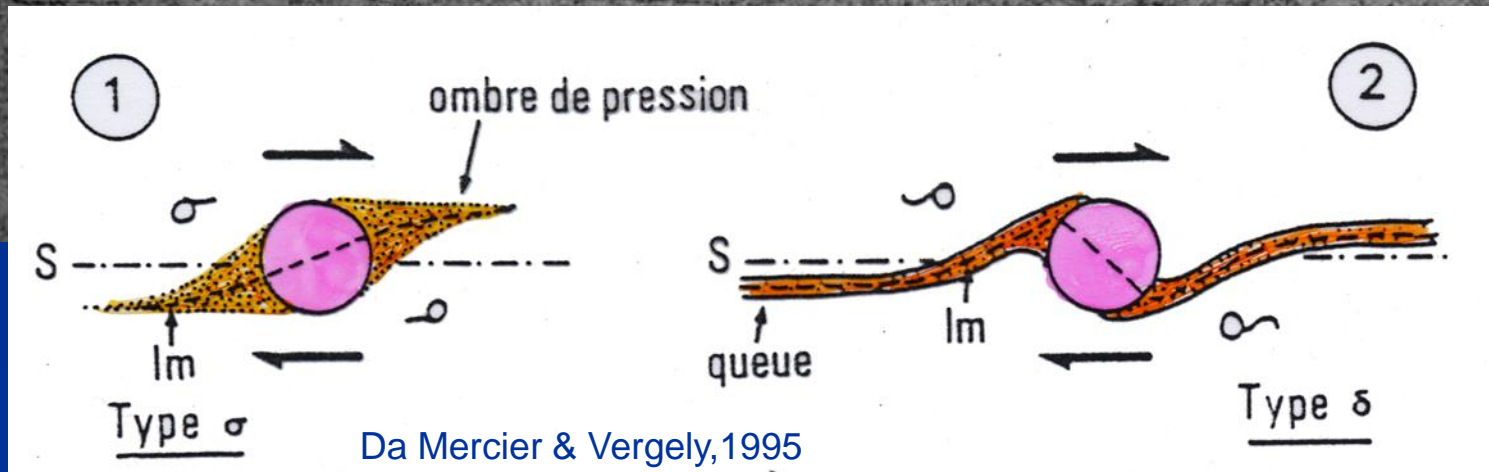


Figura 7.20. Relazioni tra simmetria delle strutture e modalità deformativa.

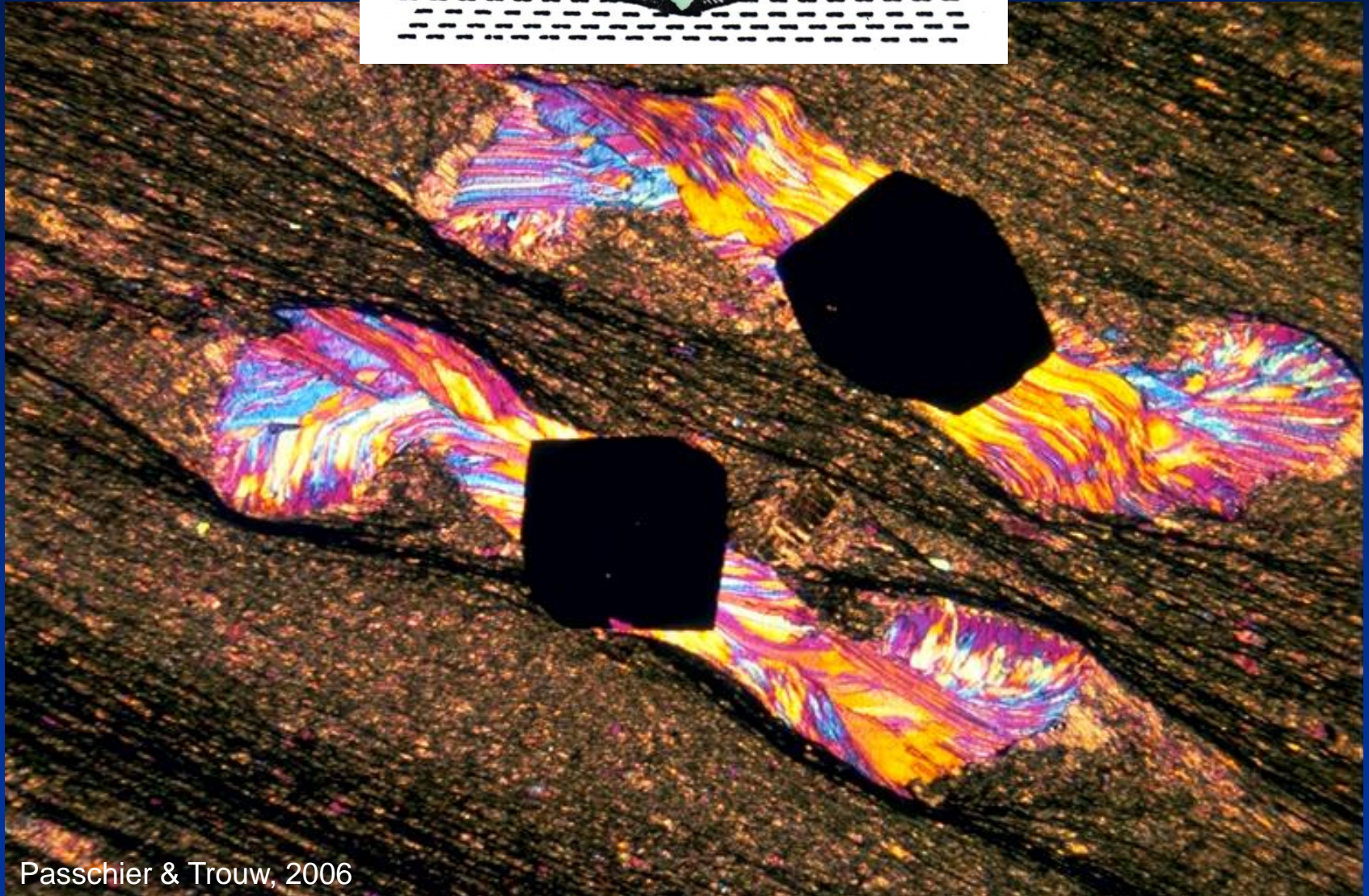


Passchier & Trouw, 2006



2

FRANGE DE PRESSION



Fabric “snowball” a “S” nei porfiroclasti

4 INCLUSIONS ORIENTEES



Da Mercier & Vergely, 1995

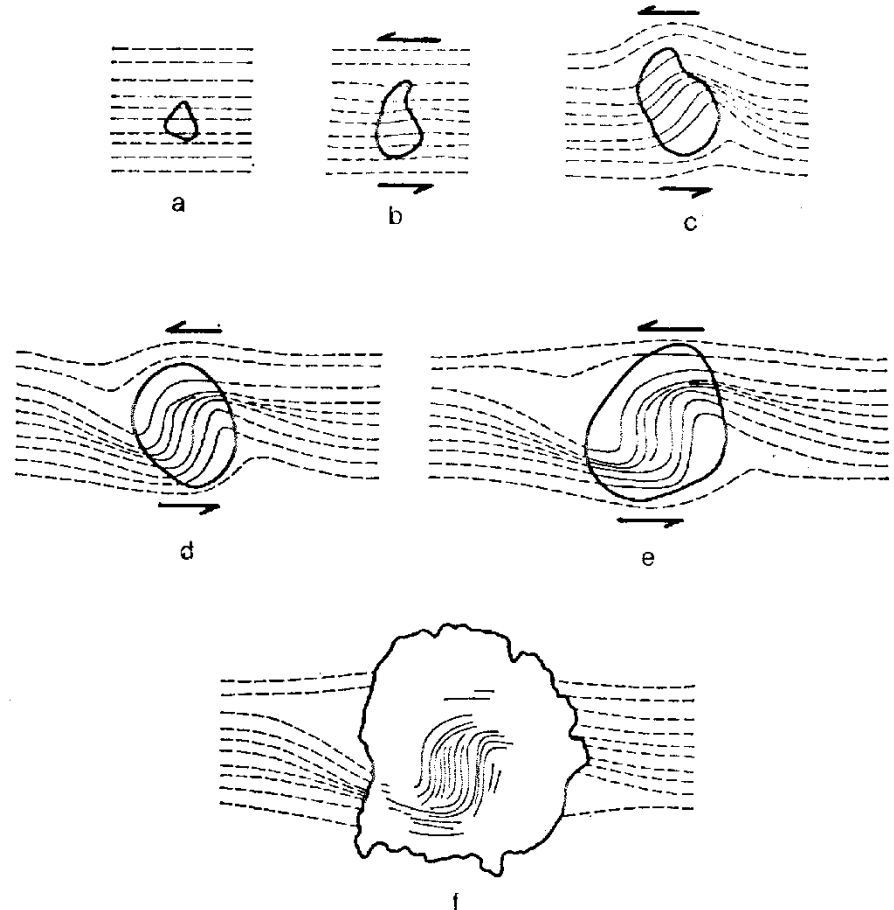
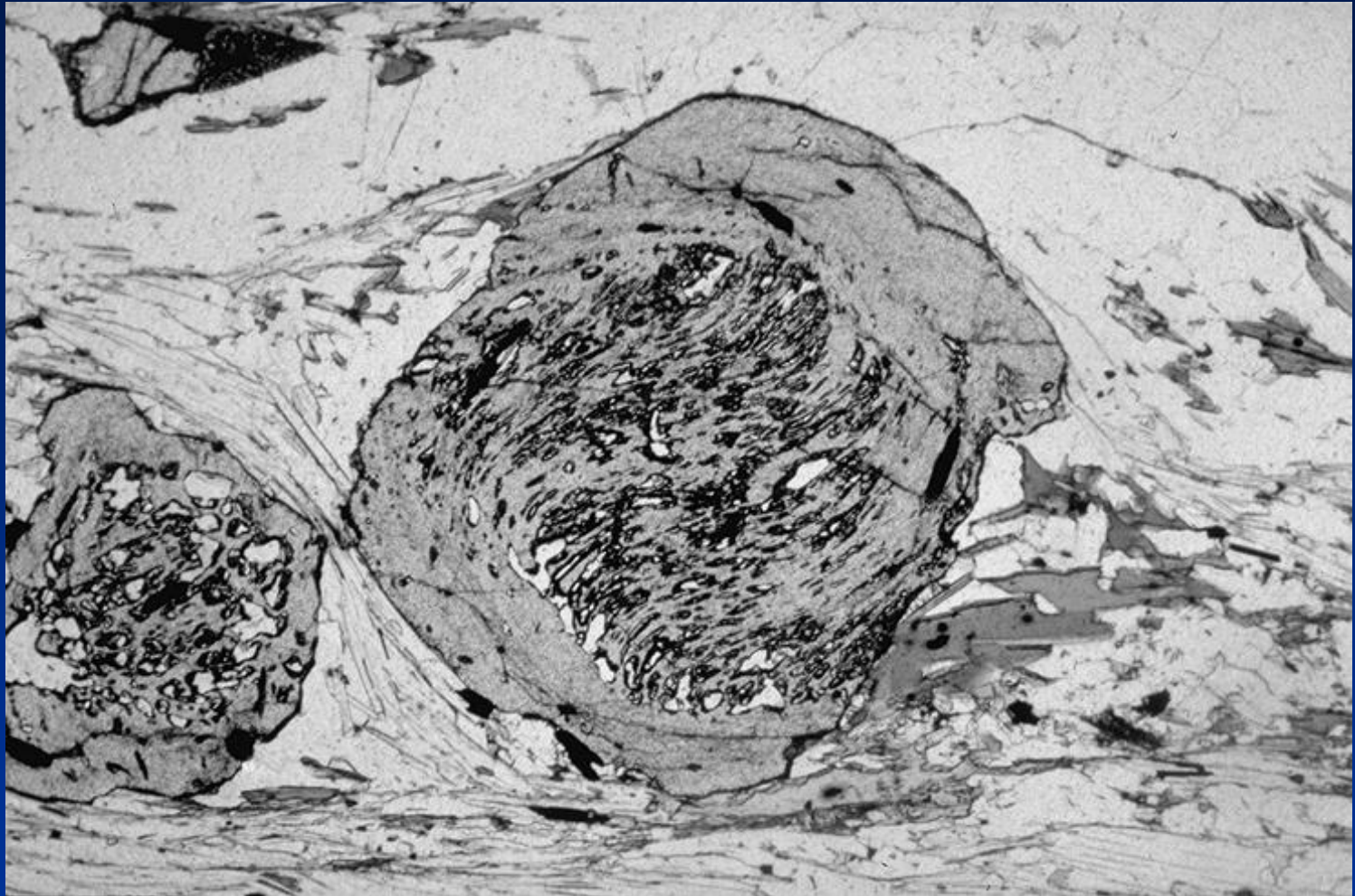


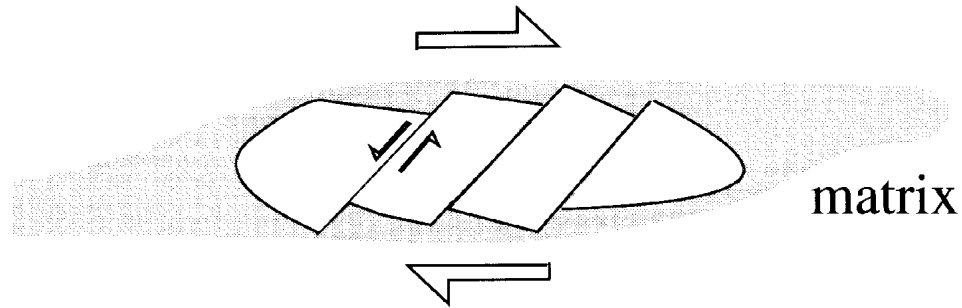
Figure 9.5 Model for the development of Snowball S-fabrics in porphyroblasts, especially garnet (after Spry, 1963).

Da Barker, 1990



Passchier & Trouw, 2006

antithetic microfaults or shear zones in grains



synthetic microfaults or shear zones in grains

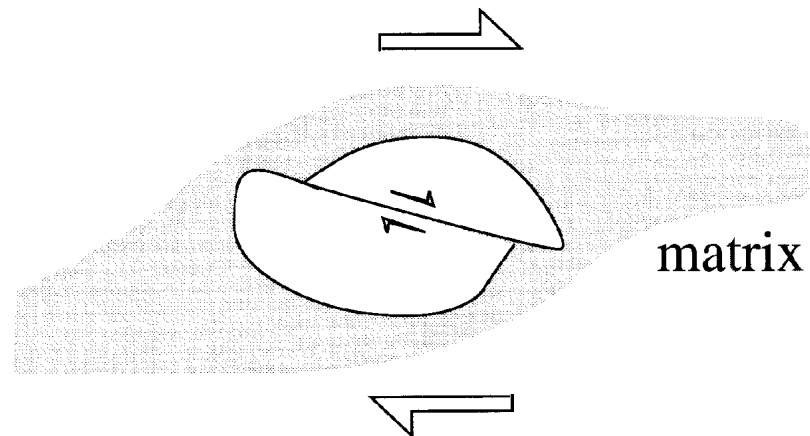
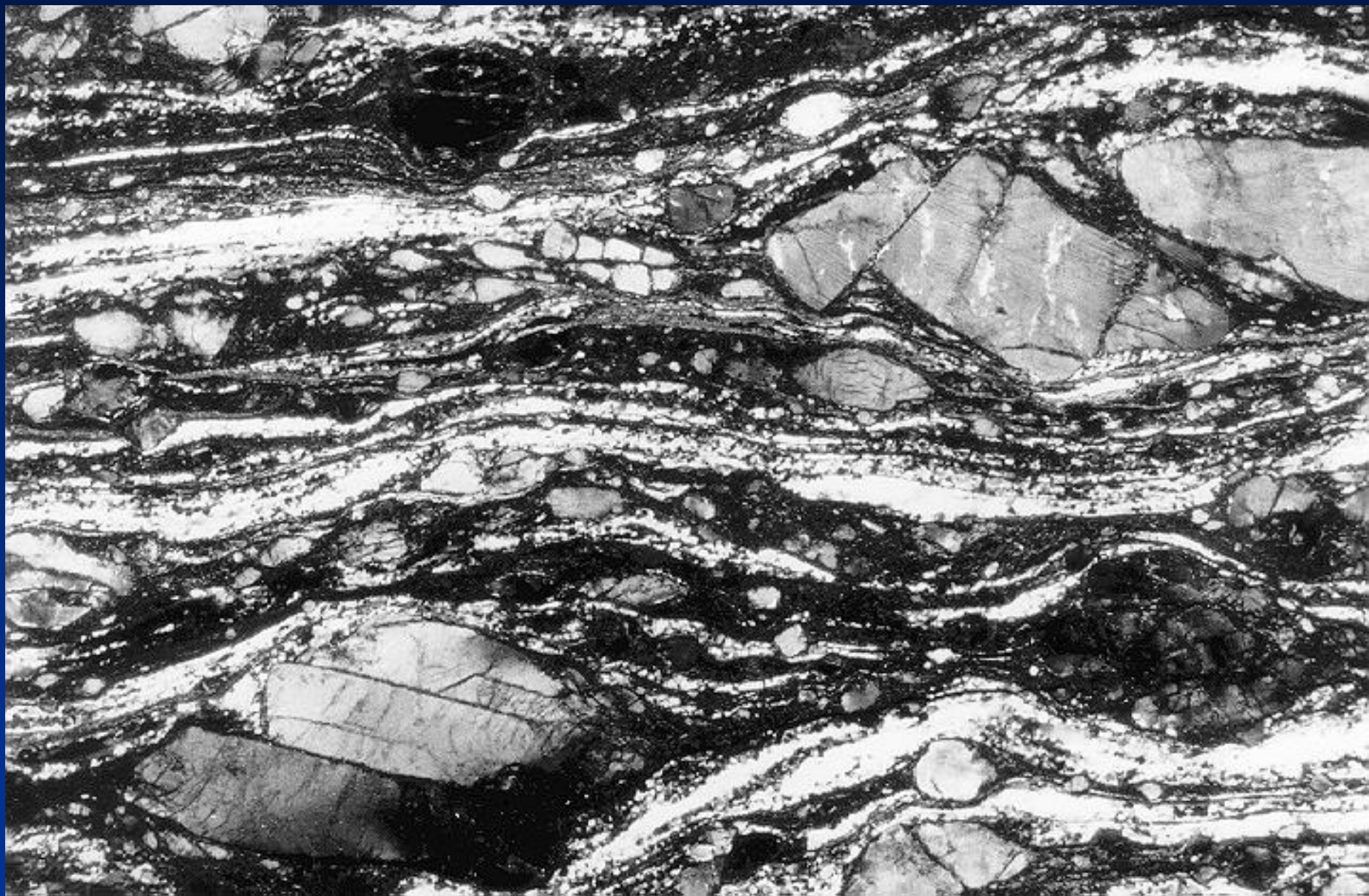


Fig. 5.31. Illustration of the two mechanisms of formation of stepped fragmented grains at similar bulk shear sense (*large arrows*)



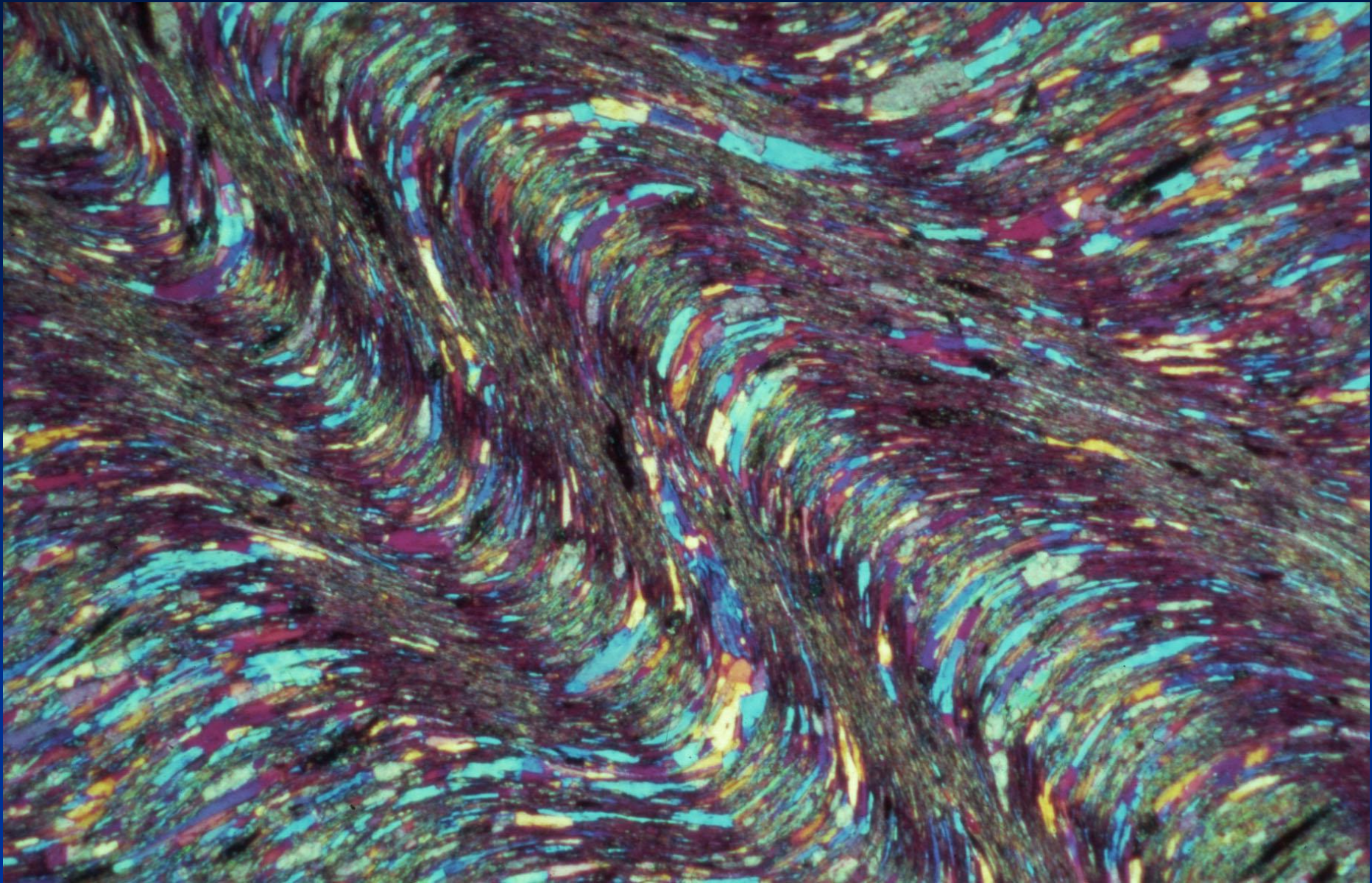
Clivaggio da crenulazione



Da Ramsay and Huber, 1987



Da Ramsay and Huber, 1987



Da Ramsay and Huber, 1987



Passchier & Trouw, 2006

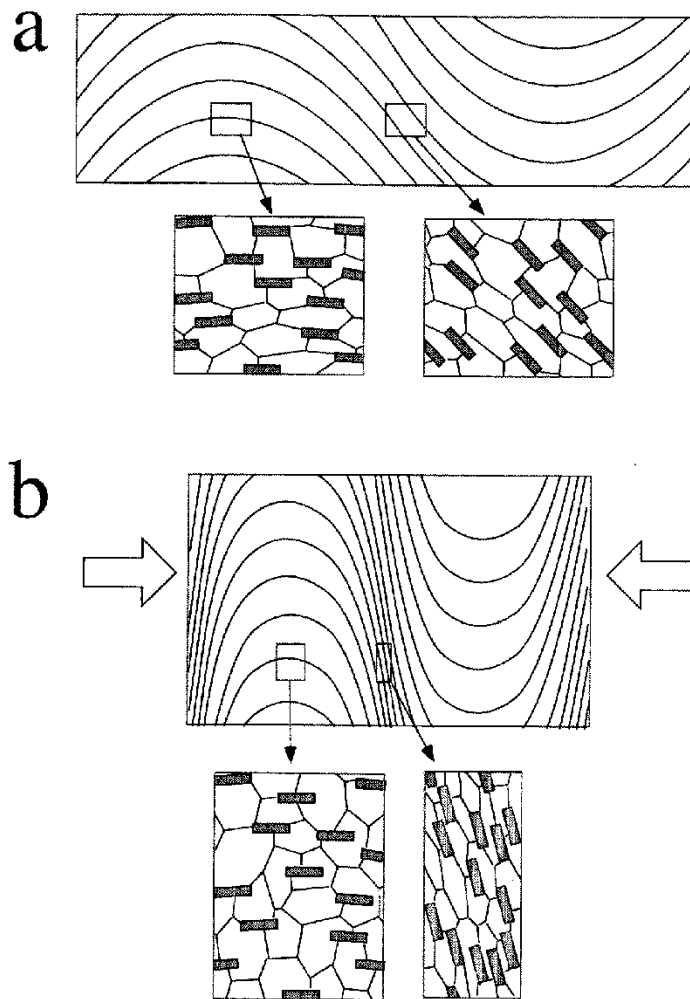
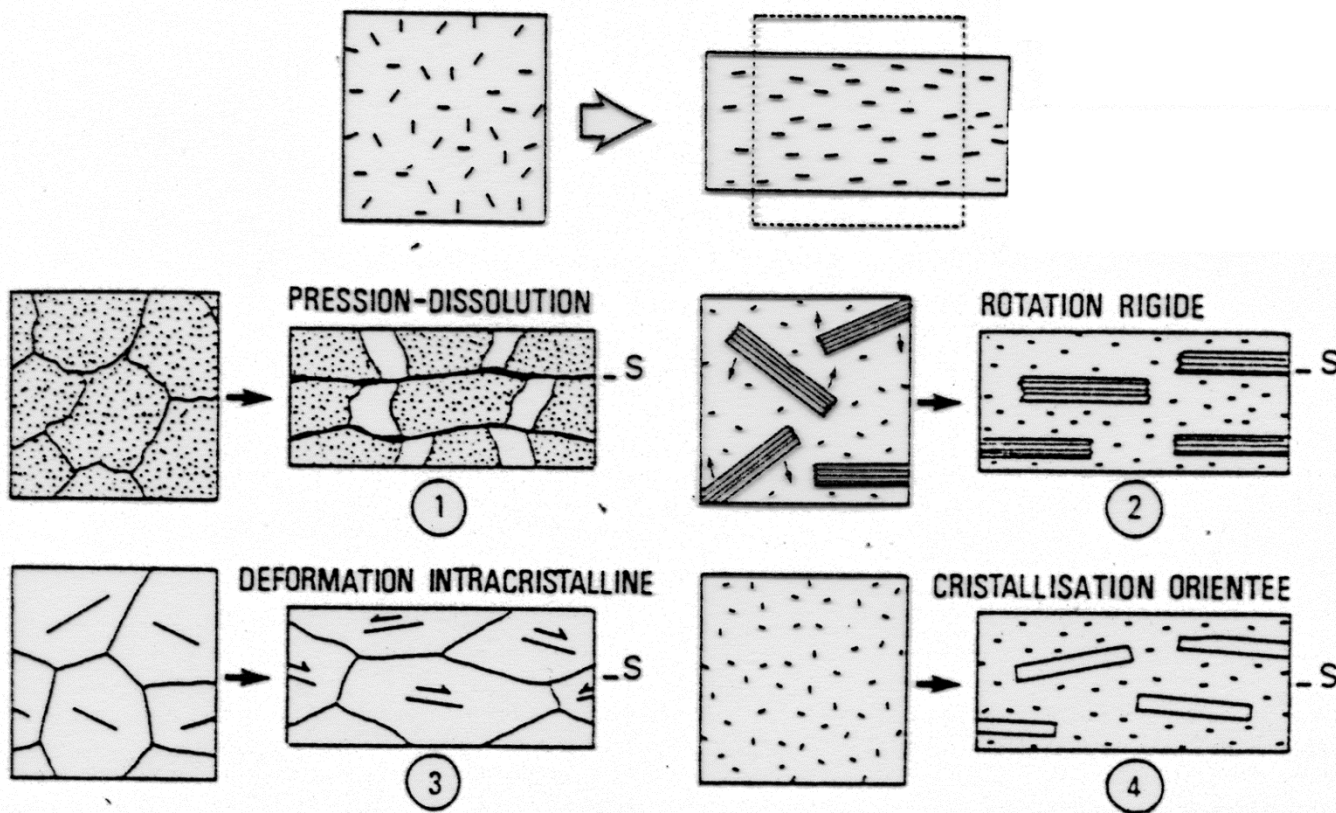
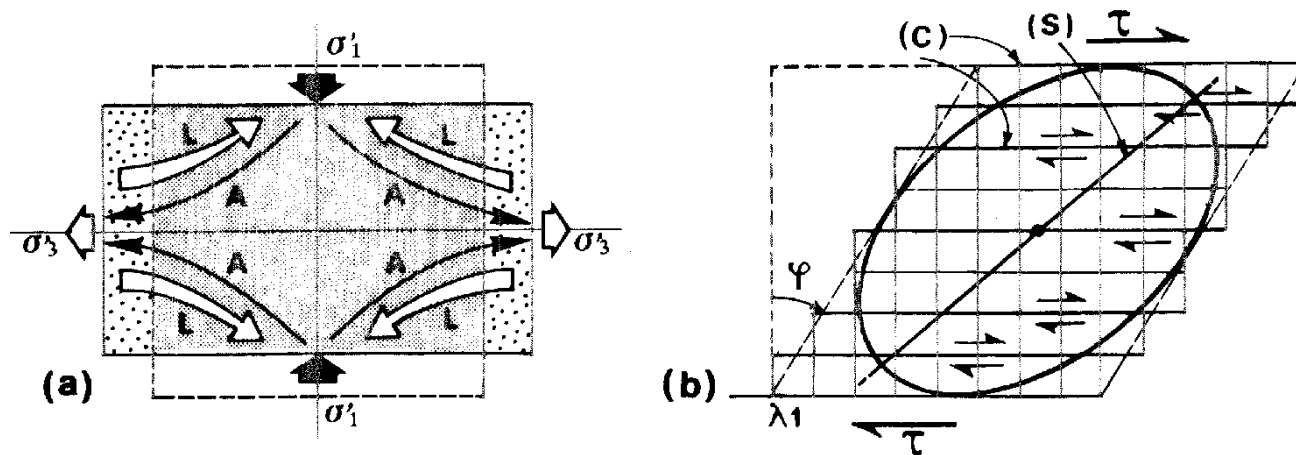


Fig. 4.21 a,b. Progressive tightening of folds with formation of a differentiated crenulation cleavage (S_2) by preferential dissolution of quartz in fold limbs caused by the orientation of quartz-mica contacts with respect to the σ_1 direction; resolved normal stress over these contacts is higher in fold limbs than in hinges. **a** and **b** are two stages in progressive deformation (cf. Figs. 4.11, 4.12)

Genesi della foliazione



Da Mercier & Vergely, 1995



- 7.2. (a) Déformation coaxiale d'un cristal par diffusion des atomes (A) et des lacunes (L) ;
 (b) Déformation non co-axiale d'un cristal par glissement sur une seule famille de plans cristallographiques.

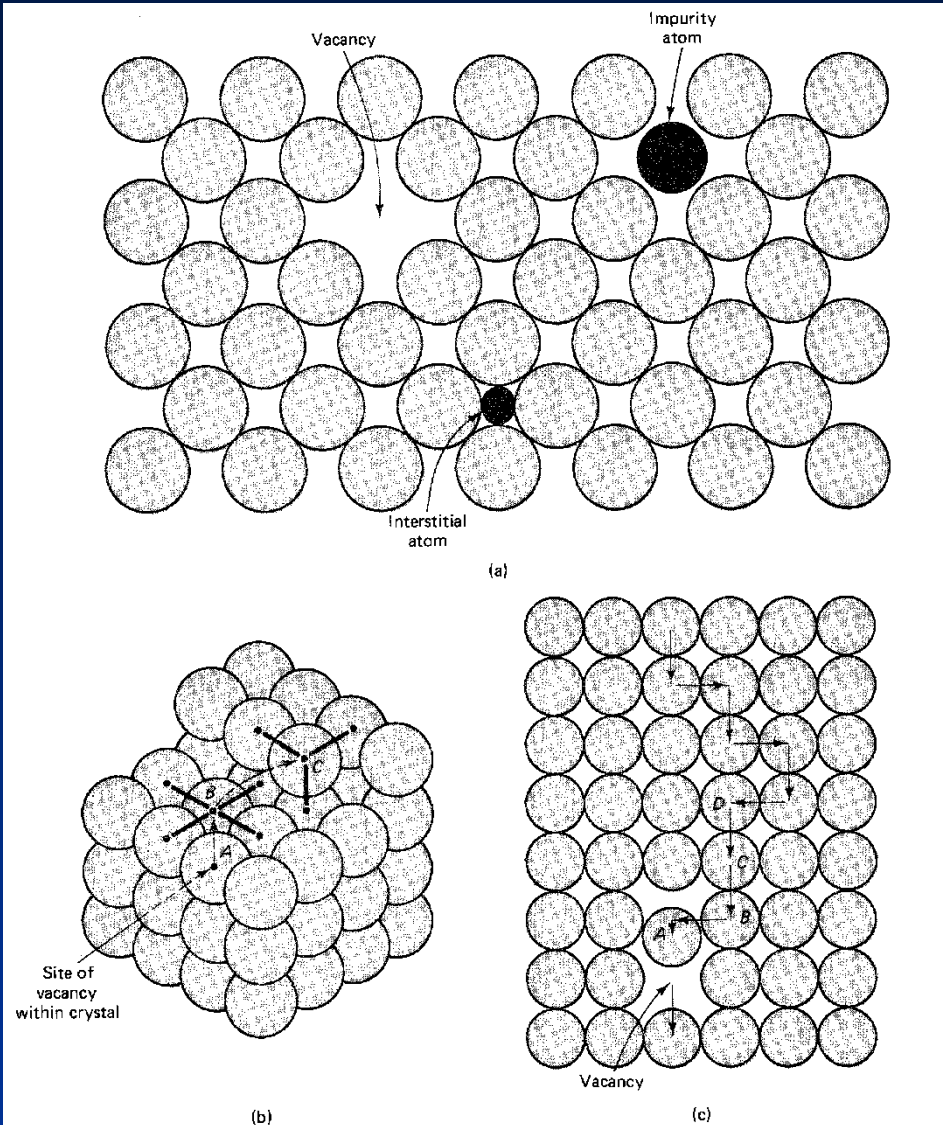
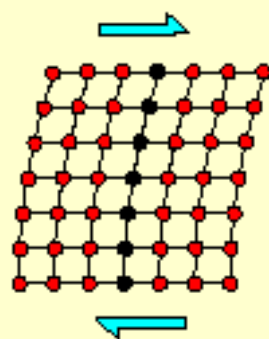
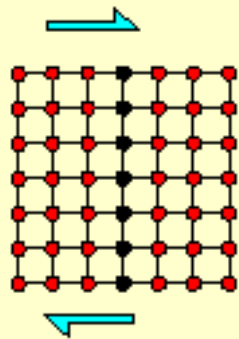
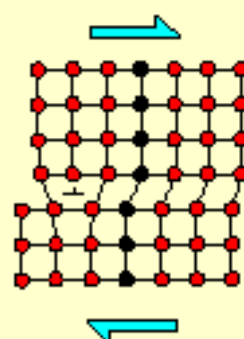


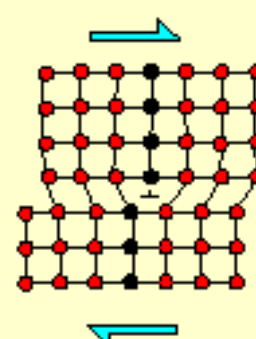
FIGURE 4-5 (a) Simple kinds of point defects. (b) Creation of a vacancy at A, one layer below the surface of the crystal, requires breaking five bonds of the atom at B, moving it to C on the surface of the crystal and forming three bonds, breaking five bonds of the atom at A, and moving it to B, forming four bonds. Thus the energy required to form the vacancy is the energy of the net three bonds broken. (c) Vacancies play an important role in solid-state diffusion. For example, atom A is moving into an adjacent vacancy, atom B may then move into the hole left by A, atom C may then move into the hole left by B, and so on, producing a flux of one atom downward across the crystal and one vacancy upward across the crystal.



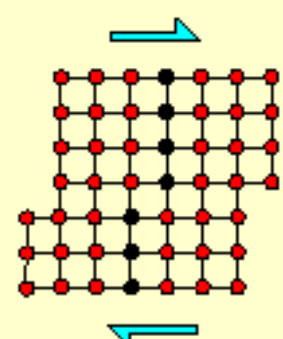
elastic
deformation



introduction
of
dislocation



migration
of
dislocation



crystal shape has changed
without mechanical
fracturing or loss of crystal
structure

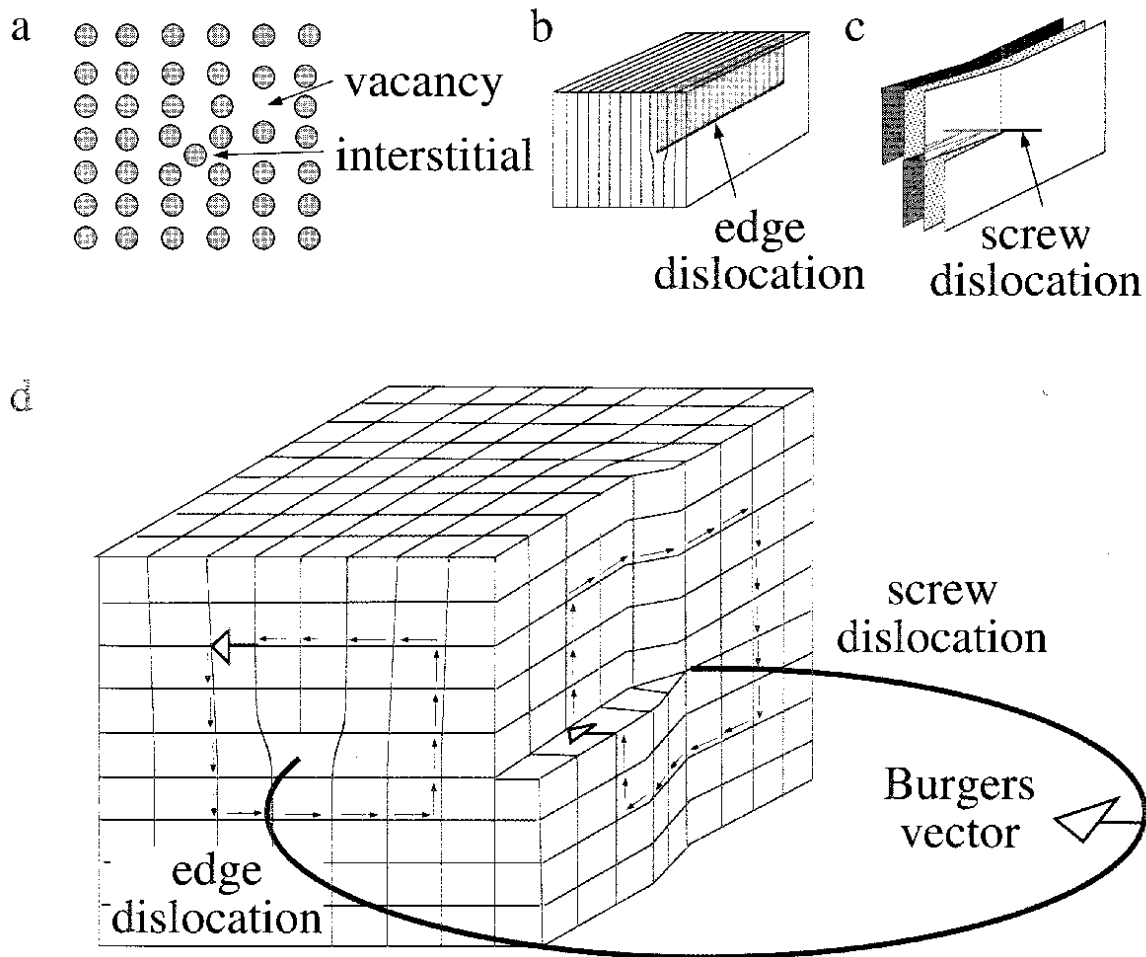
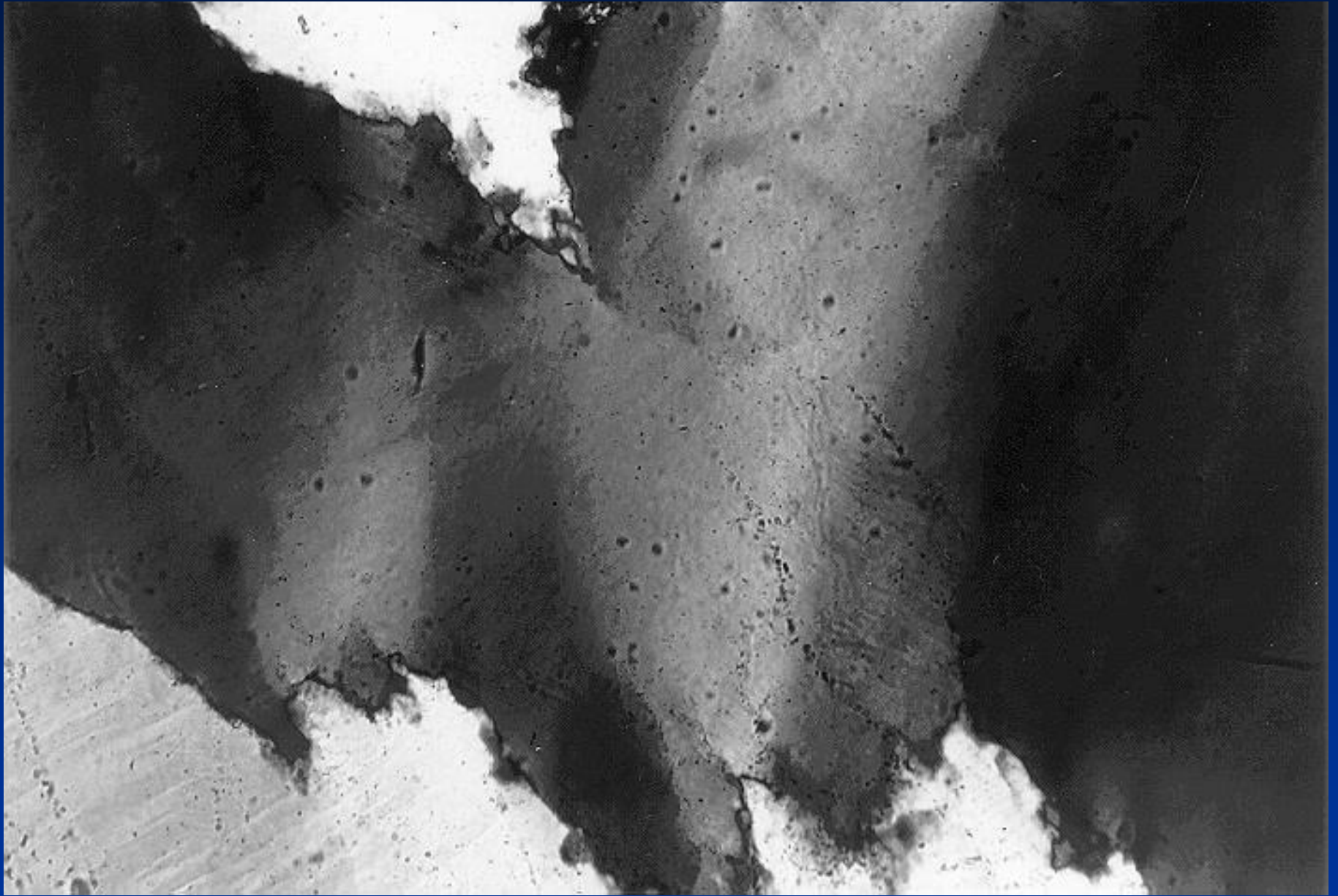
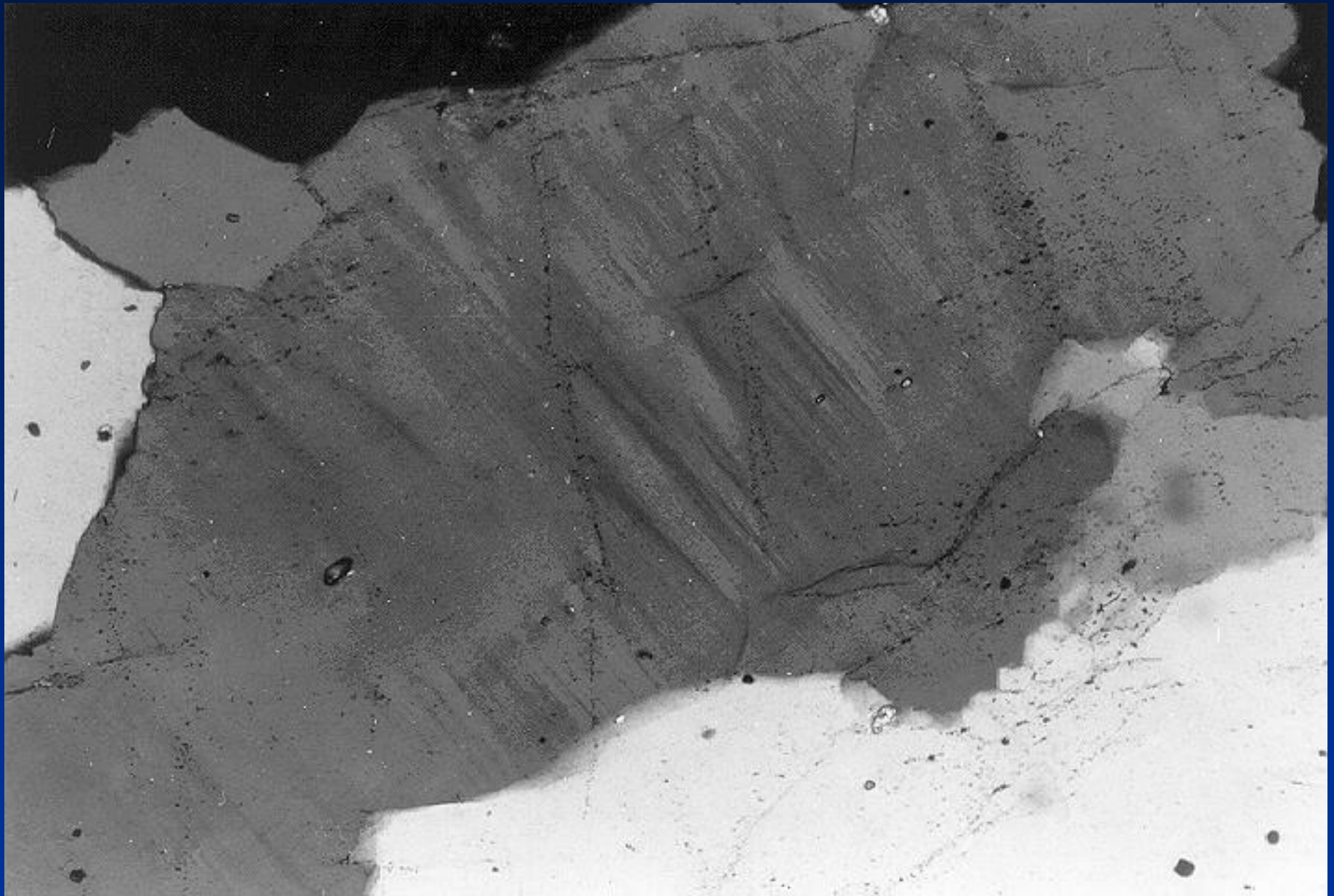


Fig. 3.7. **a** Lattice with two types of point defects. **b** Edge dislocation defined by the edge of a half-plane in a distorted crystal lattice. **c** Screw dislocation defined by a twisted lattice. **d** Dislocation with edge and screw dislocation regions in a

crystal. A square itinerary of small arrows around the dislocation is used to find the Burgers vector of the dislocation, indicated by *open arrows*

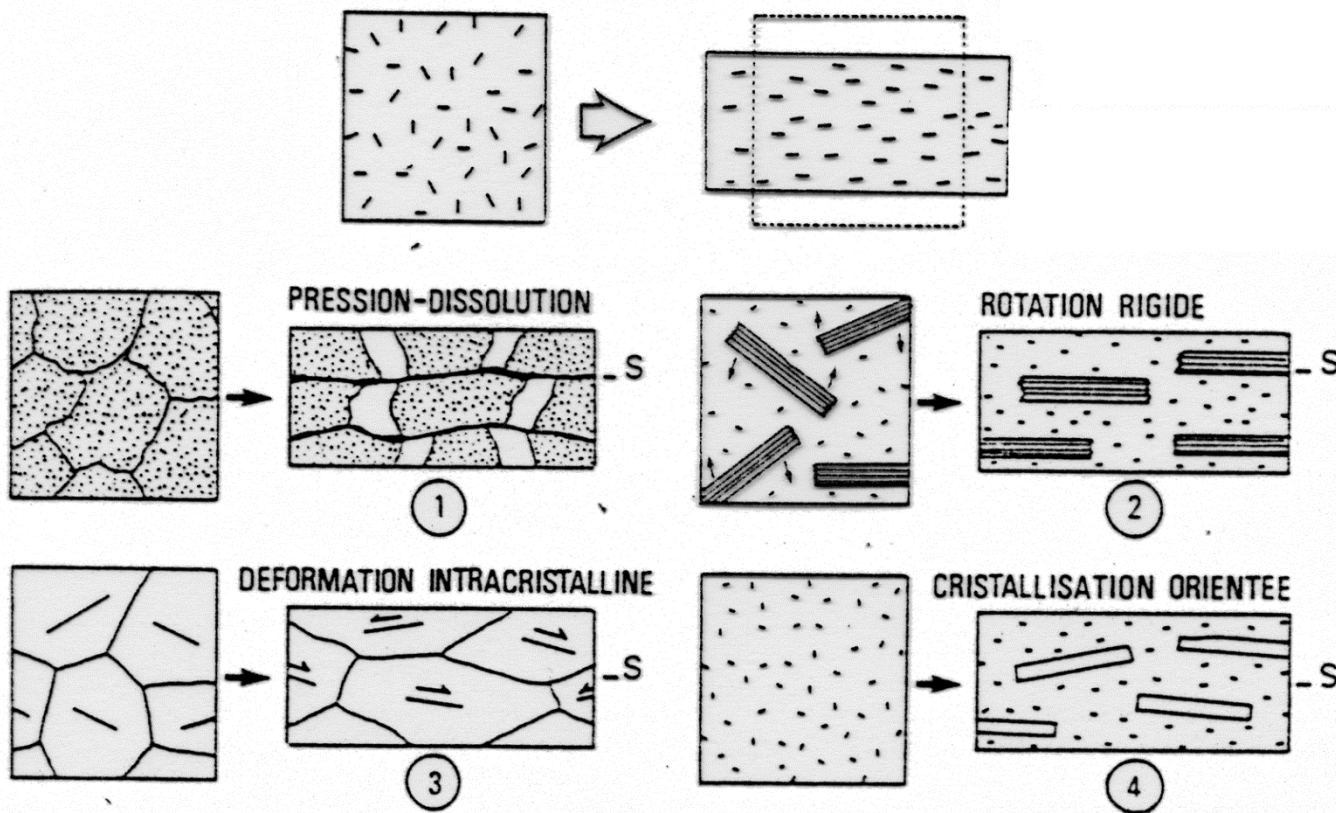


Da Passchier & Trouw, 2006



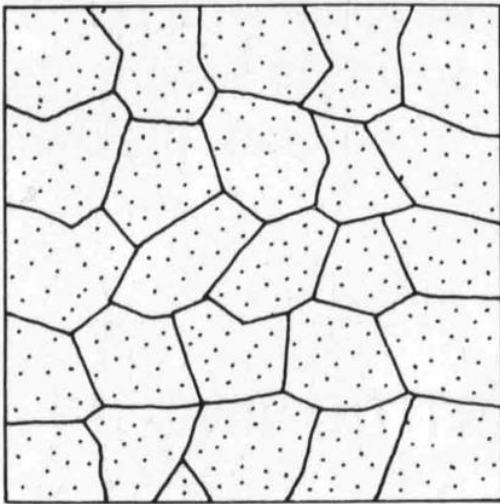
Da Passchier & Trouw, 2006

Genesi della foliazione

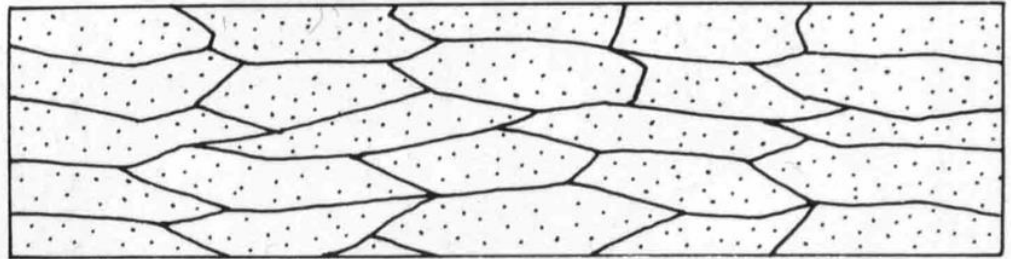


Da Mercier & Vergely, 1995

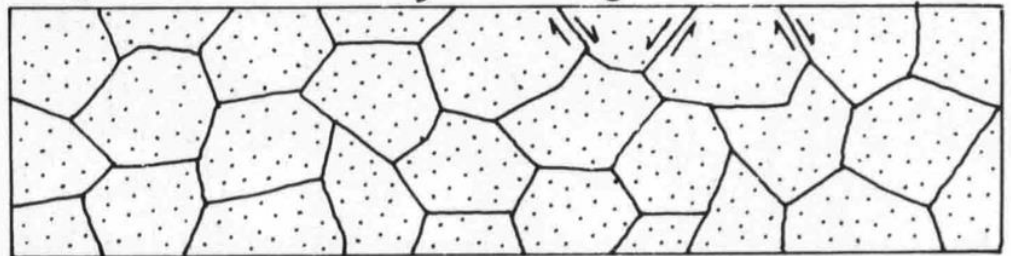
A. original aggregate



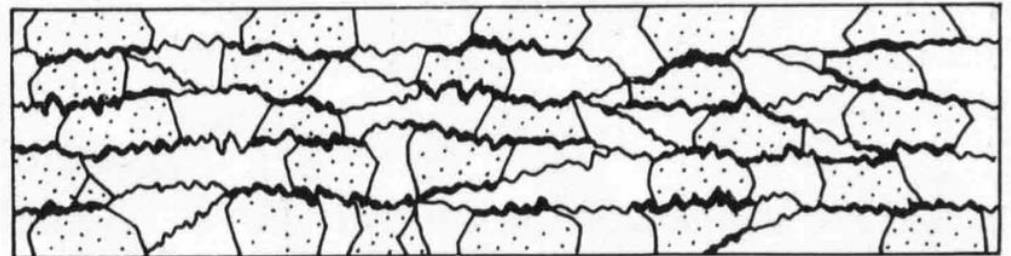
B. crystal plasticity

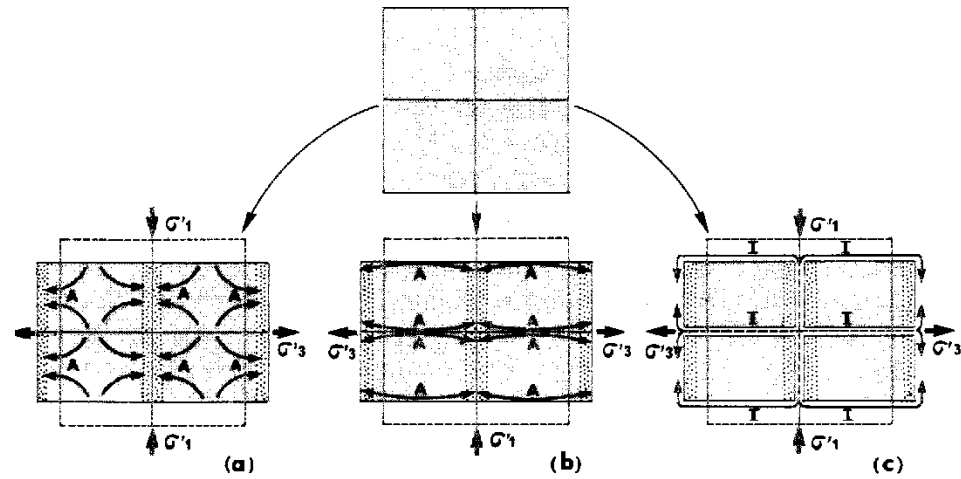


C. grain boundary sliding

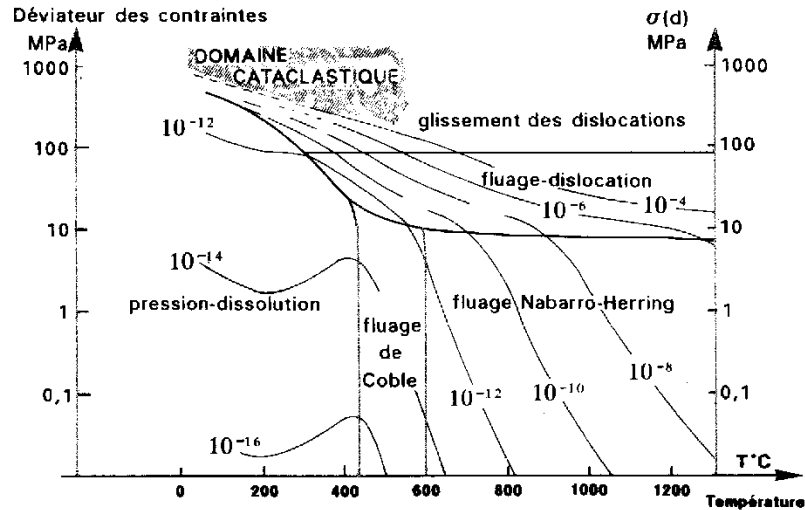


D. pressure solution





7.6. Mécanismes de transfert de matière par diffusion (a) fluage de Nabarro-Herring, (b) fluage de Coble et (c) par pression-dissolution. La forme initiale des grains est en tirets. A : atomes, I : ions.

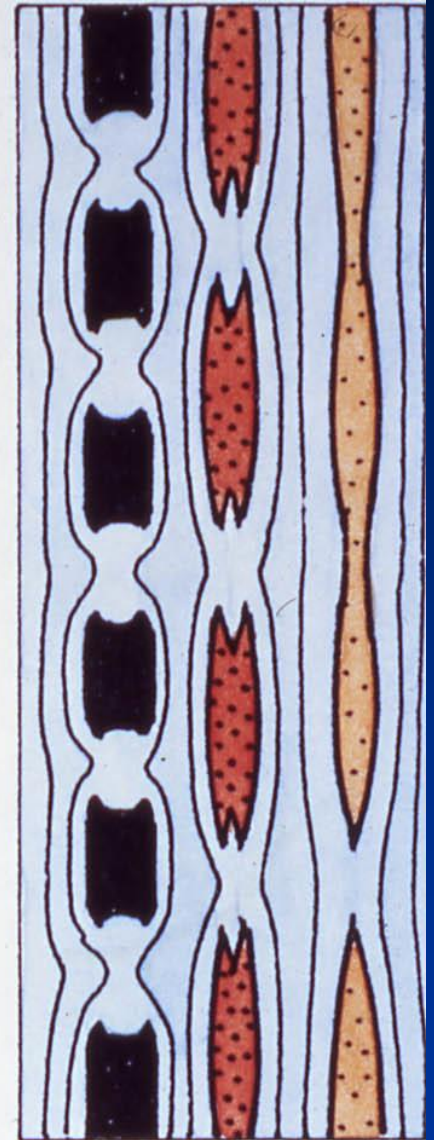
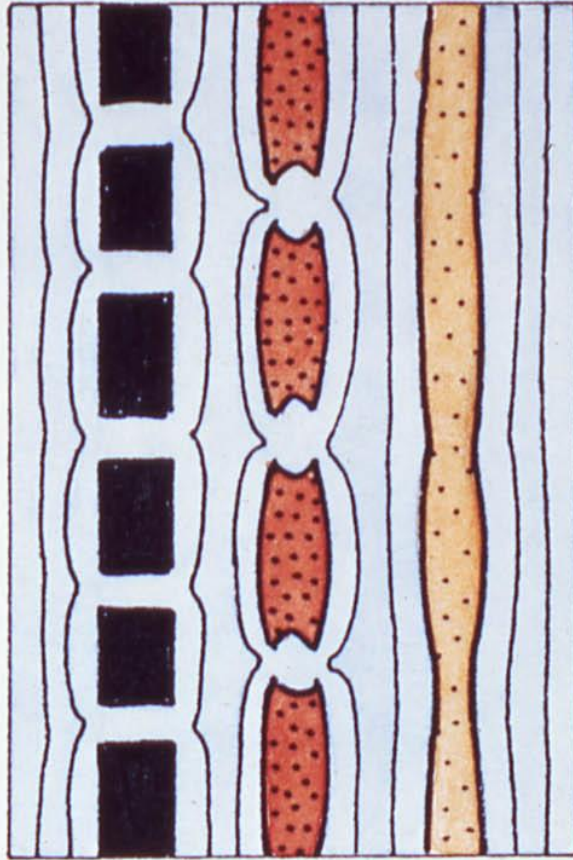
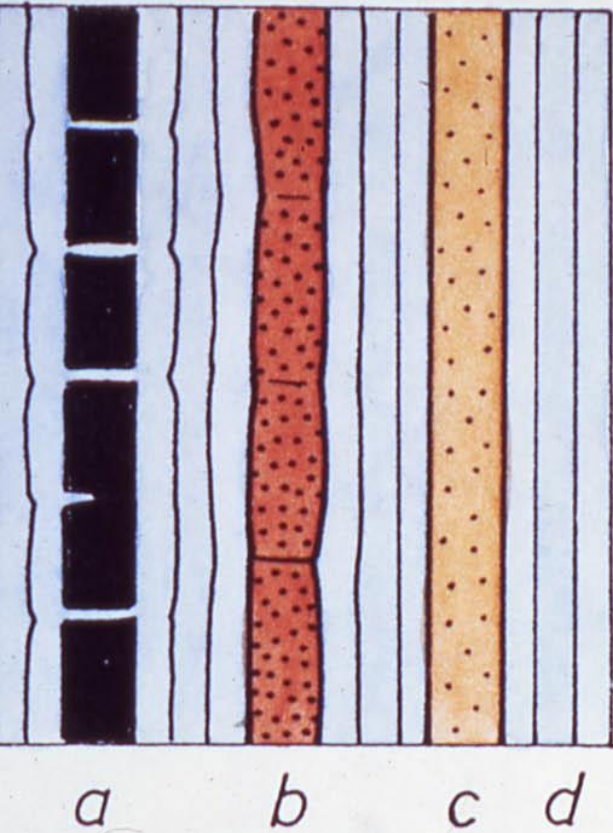


7.7. Carte des domaines (T – σ) de déformation de la calcite ; la taille des grains est de 100 μ et la pression de fluide de 100 MPa pour la pression-dissolution (d'après Rutter, 1976, *Phil. Trans. Roy. Soc. London*, A283, 43-54). Les courbes représentent les taux de déformation par seconde. On a considéré que pour $\dot{\epsilon} > 10^{-4}$ S⁻¹ la déformation est cataclastique à basse température.

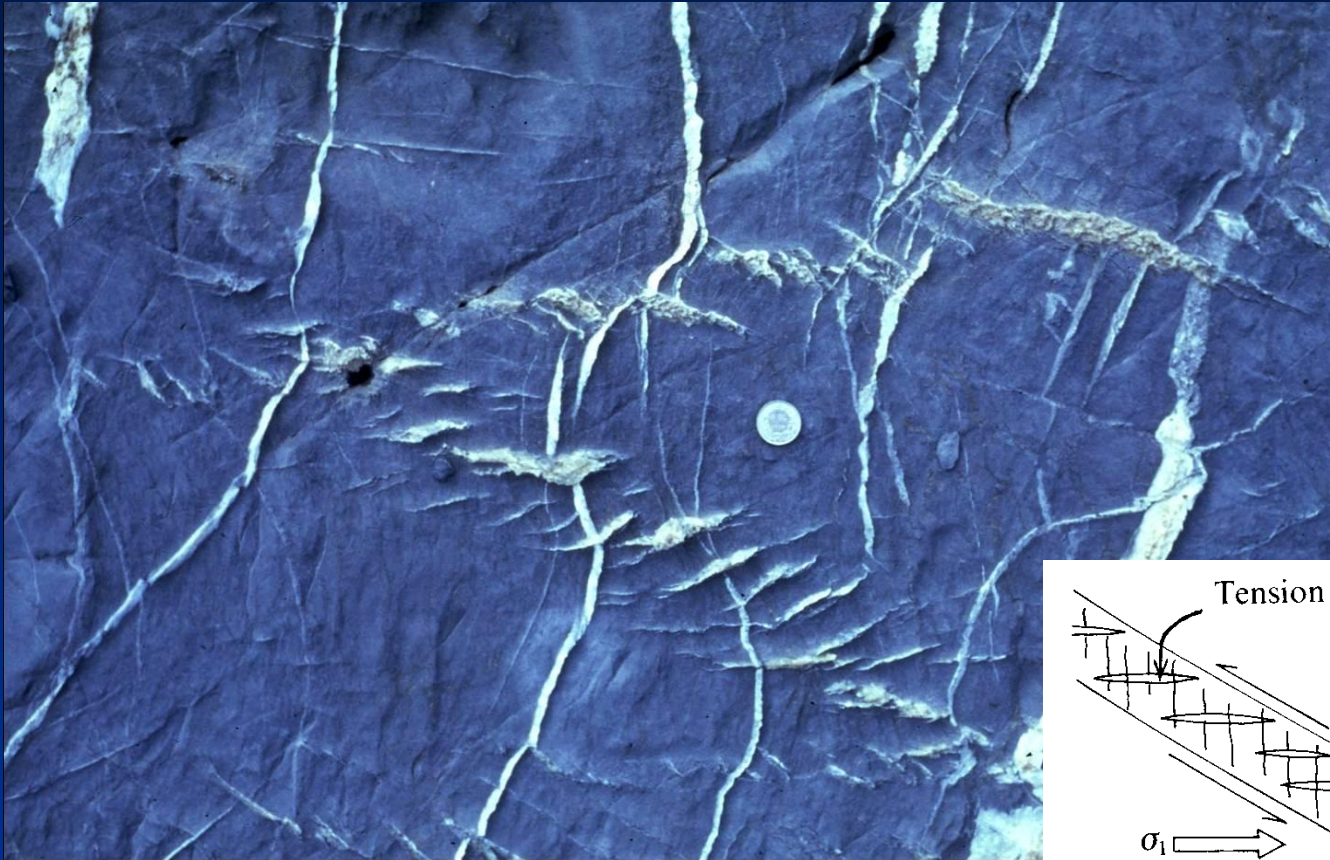
Strutture fragili-duttili

(certi casi di boudinage; vene a schiera)

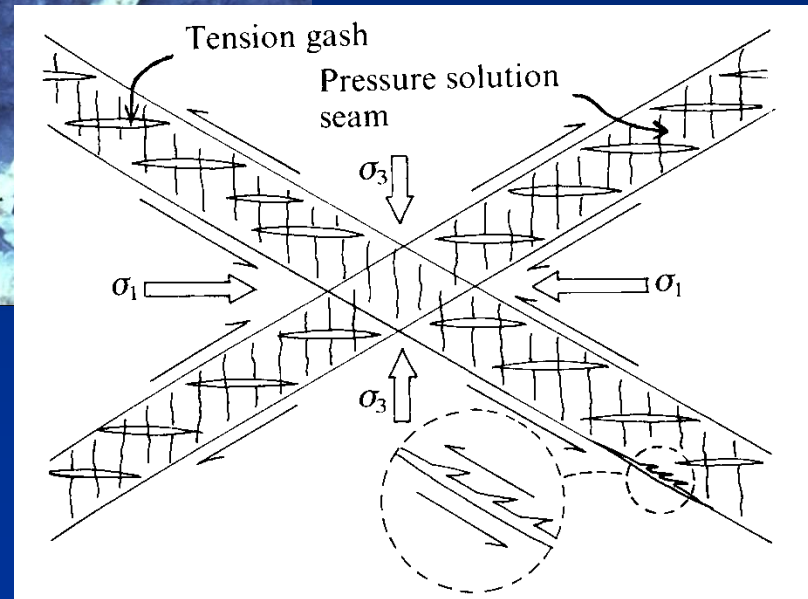
Strutture fragili-duttile: certi casi di boudinage



Strutture fragili-duttili: vene sigmoidali a schiera



Da Ramsay and Huber, 1987



Da Price and Cosgrove, 1990



Da Ramsay and Huber, 1987

Da Mercier & Vergely, 1996

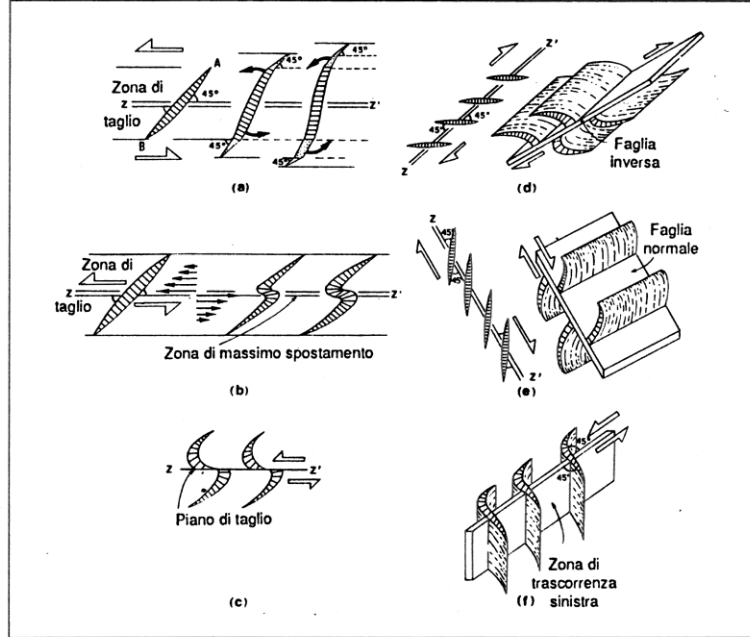
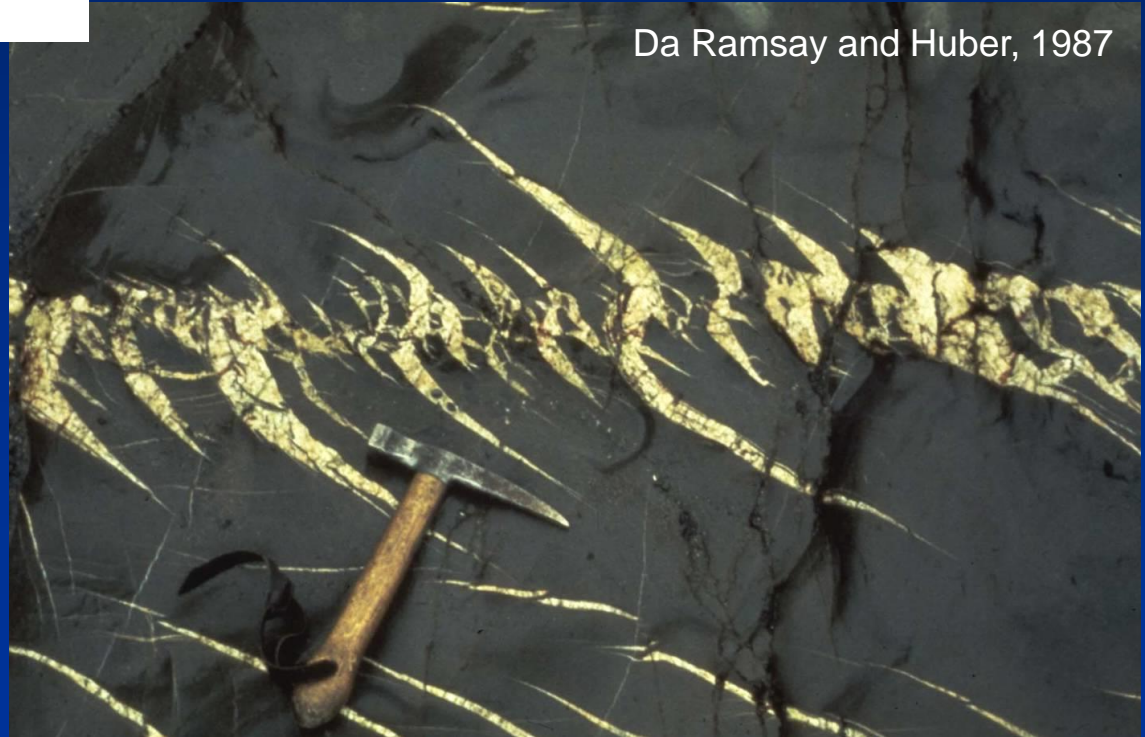


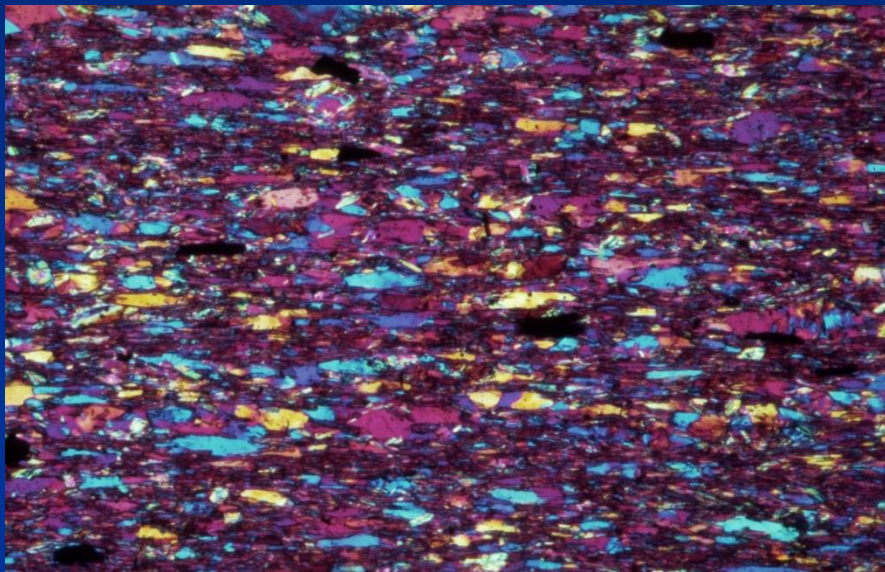
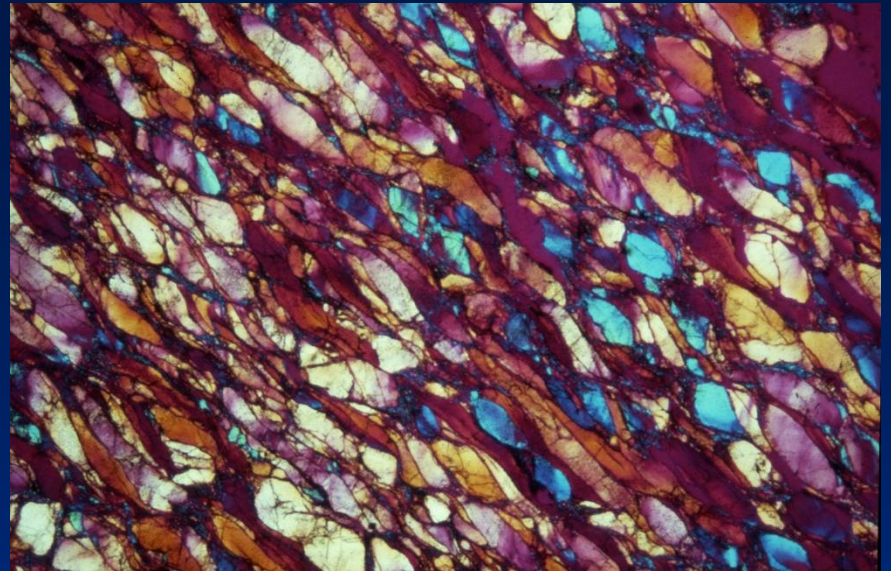
Figura 4.18. Squarci da tensione «en échelon» lungo una zona di taglio zz' .



Da Ramsay and Huber, 1987

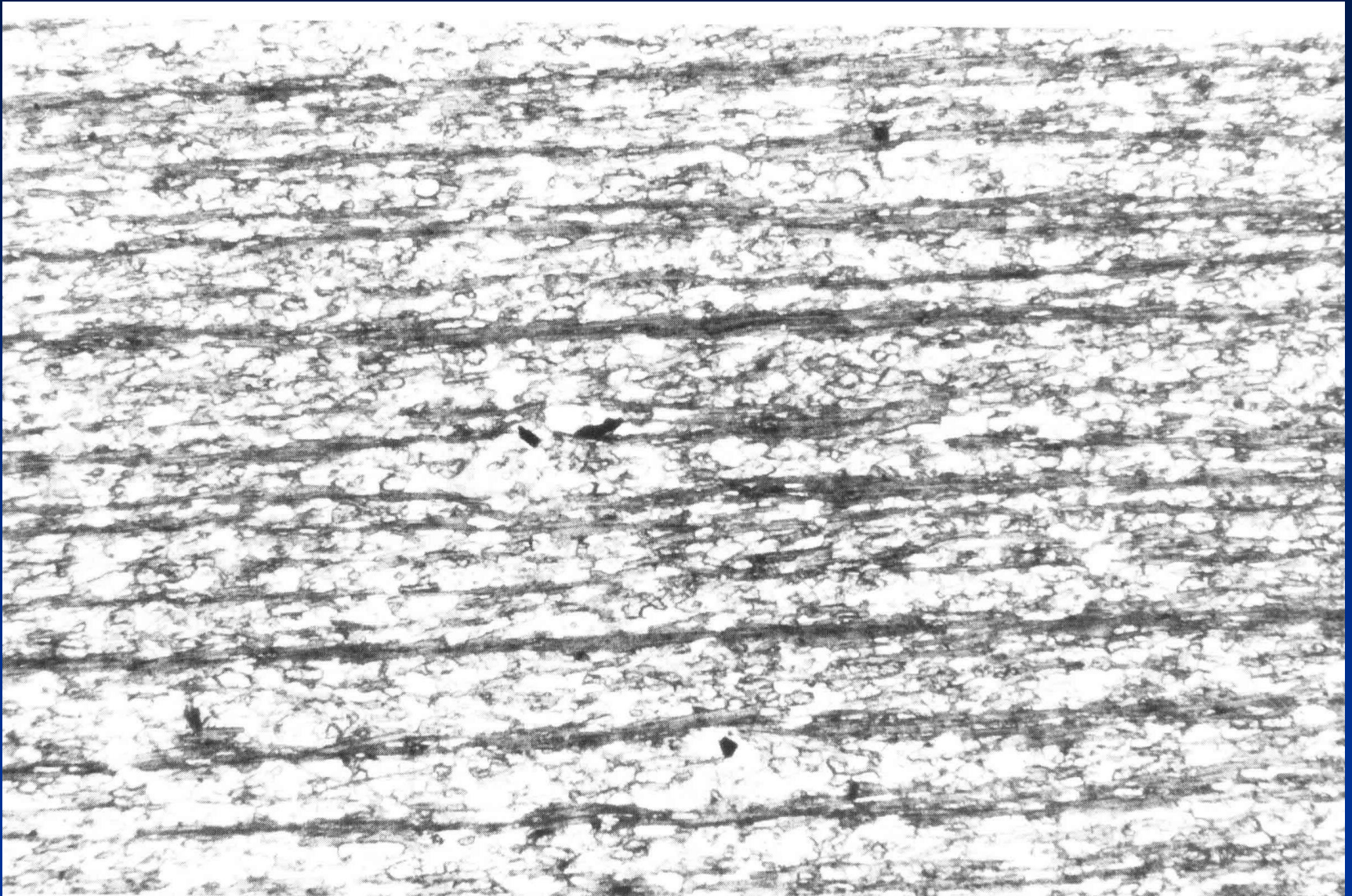


Classificazione del Clivaggio

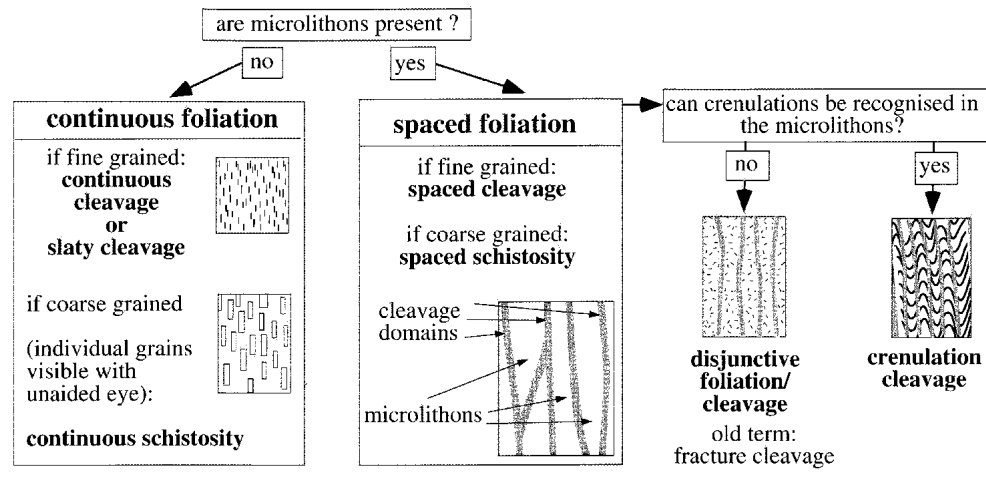


Passchier & Trouw, 2006

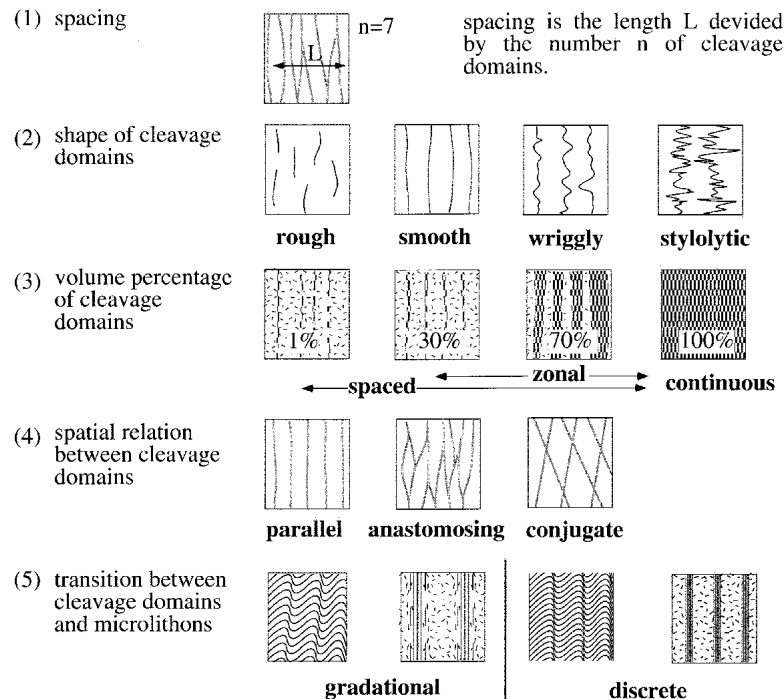
Cleavage domains e microlithons



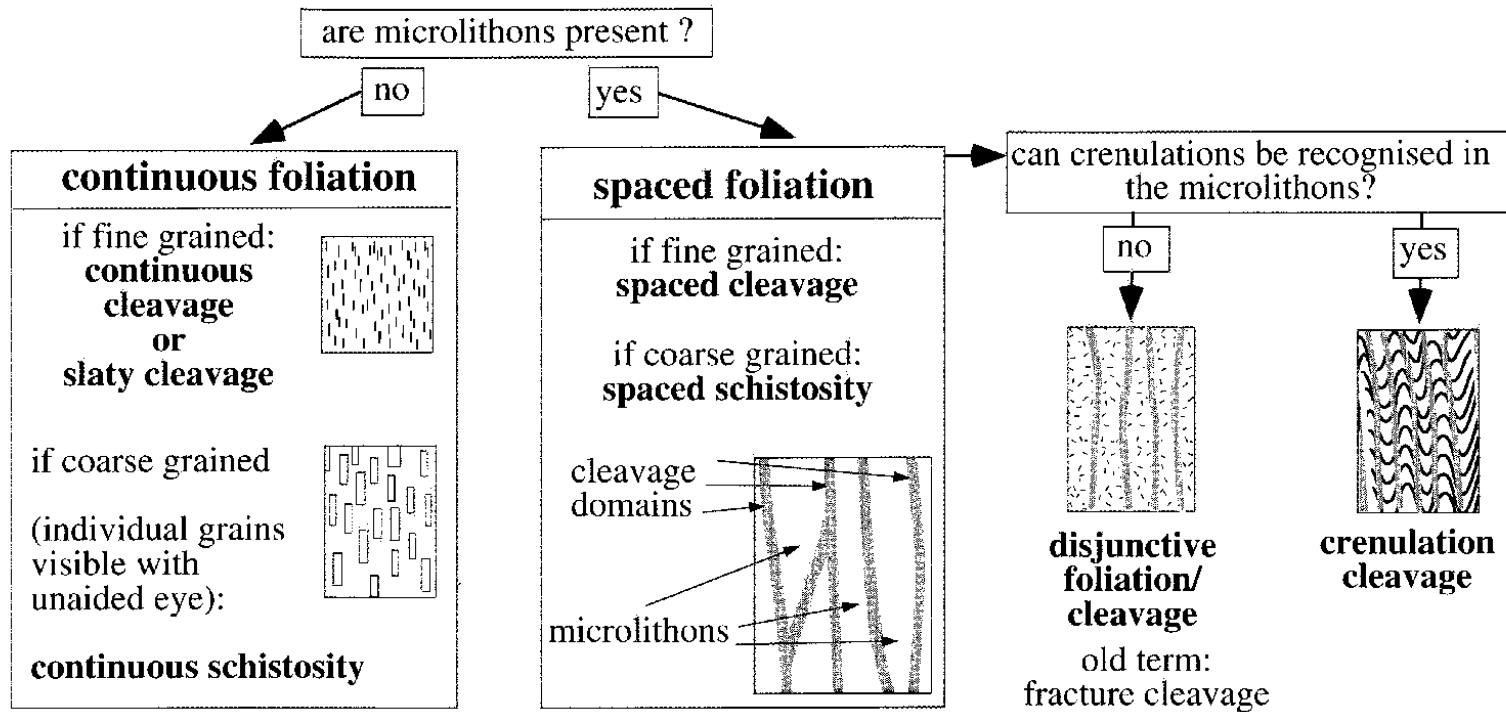
Morphological classification of foliations (using an optical microscope)



Useful criteria to describe spaced foliations :

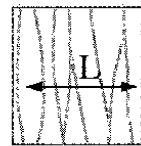


Morphological classification of foliations (using an optical microscope)



Useful criteria to describe spaced foliations :

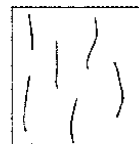
(1) spacing



$n=7$

spacing is the length L divided by the number n of cleavage domains.

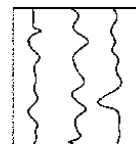
(2) shape of cleavage domains



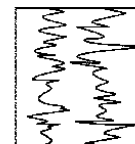
rough



smooth



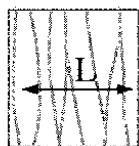
wiggly



stylolitic

Useful criteria to describe spaced foliations :

(1) spacing



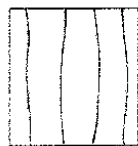
$n=7$

spacing is the length L divided by the number n of cleavage domains.

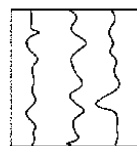
(2) shape of cleavage domains



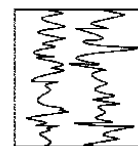
rough



smooth

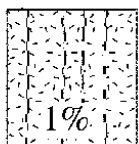


wiggly

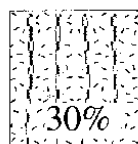


stylolitic

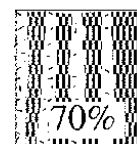
(3) volume percentage of cleavage domains



1%



30%



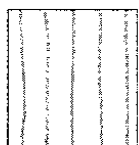
70%



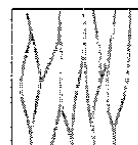
100%

← spaced — zonal —→ continuous

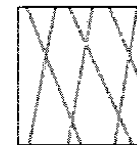
(4) spatial relation between cleavage domains



parallel

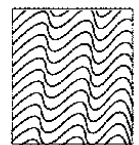


anastomosing

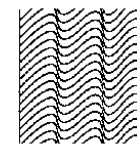
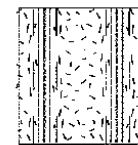


conjugate

(5) transition between cleavage domains and microlithons



gradational



discrete

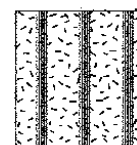


Fig. 4.6. Morphological classification of foliations using an optical microscope. (After Powell 1979 and Borradaile et al. 1982)