

Exam "Dynamics of Basins and Orogens" (GEO4-1418)

Friday, February 4, 2005

Note. Read the questions well. Formulate your answers in a concise way; make drawings whenever you think this will clarify your explanation. Write your name + student number on each sheet you hand in.

Note. It is allowed to answer the questions in Dutch (but not in Portuguese).

Question 1. Fieldwork in part of the southern Alps has revealed a sedimentary sequence that is thought to have been deposited in a passive margin setting which existed sometime during the Mesozoic, well before the convergence of Africa and Eurasia started and the Alps were formed.

(1a) Which characteristics of the sedimentary sequence may have led the researchers to their interpretation in terms of a passive margin?

(1b) How will the subsidence history recorded by the sedimentary sequence differ from that of a typical foreland basin?

Question 2. Most orogenic belts reveal rocks that underwent metamorphism due to exposure to elevated temperature and pressure. Discuss how metamorphic petrology, structural geology, and numerical modelling can be combined in order to gain insight into the causes of metamorphism.

Question 3. One of the important theoretical concepts that has been developed in the study of both basins and orogens is that of gravitational potential energy.

(3a) Explain what is meant with the term "gravitational potential energy" (in the context of lithosphere dynamics) and explain how it is quantified.

(3b) Explain, using the concept of gravitational potential energy, why some orogenic belts are subject to extension in the direction *parallel to the strike* of the belt.

Question 4. On the other side of this sheet you will find a cross section through the topography of the Betic zone of southeast Spain. This section clearly illustrates the typical Basin-and-Range type morphology of the region.

A French group of geologists from Université Pierre et Marie Curie in Paris has recently studied the subsidence history of two of the Neogene basins encountered in this section, i.e., the Huerca Overa and Tabernas basins. This study included backstripping of the Neogene stratigraphy. In their analysis, the authors assume local (Airy) isostasy.

Discuss the validity of the assumption of local isostasy against the background of the topography of the area.

