contribute significantly to knowledge of the structure, composition or physical properties in particular places: in short, the work that any national Geological Survey should concern itself with. I see no convincing evidence that more general problems in geodynamics are best answered by information along an artificially straight line, designed to go through many different countries (the cynic would say, in order to raise both money and the political temperature). I would be surprised to find anyone who thought that a seismic line aimed at revealing insights into the recent and active evolution of the Mediterranean would be best sited from Genoa to Tunis: the real reason for its location is that it is a prolongation of a line 3000 km farther north in Scandinavia. The last chapter in the book, entitled *Geodynamics of Europe*, contains sections headed 'How does geology work?' and 'What drives tectonic processes?' I have to say that, in my opinion, the EGT does not contribute significantly to these general questions, nor was it ever likely to: they are much more likely to be addressed by focused, smaller projects in carefully chosen geographical locations (not necessarily in Europe) that have nothing to do with political borders and almost certainly don't lie along straight lines.

This publication will therefore appeal strongly to those who want to know about the lithosphere in particular parts of Europe. Those who seek more fundamental insights into continental tectonics and evolution will not find them here. My own view is that the EGT whole is no more than the sum of its parts: some of which are provocative and original, and others of which are not.

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Global Positioning System

Hofmann-Wellenhof, B., Lichtenegger, H. and Collins, J. 1992. *GPS Theory and Practice.* Springer, Vienna. 326 pp. Price 550 Austrian Schillings, DM 79.00 (softback).

In so far as structural geology is concerned with measuring the deformation of rocks, GPS is one of the most powerful tools of structural geology. Admittedly the use of GPS is restricted to motions of the Earth's surface, and to geologically tiny time intervals, yet no one with an interest in tectonics can afford, any longer, to be ignorant of the results of GPS work. At the heart of the study of tectonics is the need to understand the dynamics of the manifold tectonic processes whose kinematics are often adequately described already. Frequently, the ability to discriminate between competing tectonic hypotheses lies in a knowledge of the velocity field in a deforming region. The techniques of structural geology and earthquake seismology are reasonably good at providing measures of strain and strain rate, but they are incapable of yielding information on rotation, and thus on the full velocity field unless assumptions are made in addition to the measurements. Palaeomagnetic data can provide supplementary information on rotations, but very rarely on when, or how rapidly, such rotations occurred. There is a need, therefore, for a tool that allows one to measure the full displacement field in a deforming region, and geodesy provides such a tool.

Several studies of crustal deformation were carried out using the techniques of conventional geodesy (triangulation plus trilateration or triangulation alone) but such studies relied usually upon the reoccupation of geodetic networks established on surveying rather than tectonic criteria. The rapid rise of precise positioning using satellite geodesy, and in particular the availability of portable receivers of the Global Positioning Systems (GPS) has provided the opportunity for Earth Scientists to design their own networks for tectonic purposes, and to carry out the fieldwork at an accessible cost. Measurements of baseline lengths are repeatable to one part in 10^7, or better, so that in a region that is straining at $3 \times 10^{-15}\,s^{-1}$, or faster, the signal exceeds the noise in a few years. Better still, several high quality old terrestrial surveys exist, so the timescale can be extended back by decades or even a century.

For these reasons, it is likely that many readers of this journal may wish, some time soon, to come to grips with the results of GPS studies. To do this they will probably wish to dip into some authoritative text on geodesy and GPS. There are already several very good such texts, of which the book under review is one. Each text aims at as broad an audience as is possible within the constraints of a reasonable length and adequate depth of coverage of fundamentals.

Unfortunately, the potential range of readers is vast and Earth Scientists occupy a fairly small fraction of this range. Engineers, navigators, surveyors and even, perhaps, lawyers use GPS in greater numbers. Thus Earth Scientists are in a minority, even though they have been involved in GPS since its inception, and still provide part of the driving force towards the achievement of the highest precision GPS measurements. It's likely, then, that most readers of these pages will, if they are considering purchasing a GPS text for themselves, or a library, be swayed in that choice more by the degree to which the texts differ in their presentation of material relevant to the Earth Scientist than by variation in the (high) quality of presentation.

The book under review begins with chapters on the origins of GPS, and an overview of the way the system works, then chapters on reference systems, satellite orbits, the satellite signal and the quantities that can be measured using GPS. A chapter on The Survey itself follows, which is full of good advice, of a general sort. The observables you obtain from a survey are not, of course, the quantity of interest—baseline vectors—but are apparent distances to the satellites or (in geodetic practice) the phase of the signal. Considerable post-processing of data is required before the observables can be converted into the quantities of interest. Roughly one-third of the book is devoted to this processing. The book ends with a list of the application of GPS, and speculations about its future.

The book is well laid out, the mathematics is reasonable clearly presented and the references are up-to-date. Good though it is, I suspect this is not the book for an Earth Scientist. The book by Leick (1990) covers, in significantly more depth than the present one, several aspects of GPS that are valuable for the interested geologist. First, there are many more illustrations, which aid greatly in the presentation of concepts that are second nature to a surveyor but may be unfamiliar to others. In addition there is a separate chapter on the combination of GPS and terrestrial data, which is central to the use of GPS in tectonic studies, though not of great interest to other users. The two chapters on the geoid and reference systems are very clear and help drive home the important point that even when you have two time-separated, arbitrarily precise sets of GPS co-ordinators, you still have a way to go before you can determine deformation.

Leick also provides appendices on linear algebra and some of the essential statistics. To follow either of these books completely requires some trigonometry, some matrix algebra, and the tolerance of a notation involving Greek symbols. A former associate editor of *Journal of Structural Geology* assures me that such notation can constitute a barrier to understanding in otherwise well-disposed structural geologists. To him I would say two things: first if you can't use Greek symbols in a geodesy book, I don't know where you can: any Greek geodesist will tell you that geodesy is the second oldest profession, and began in Greece. Secondly, if Greek symbols turn you off, Smith (1988) has achieved the seemingly impossible task of writing a book on geodesy without equations; it even covers GPS.

REFERENCES

Leick, A. 1990. *GPS Satellite Surveying.* Wiley-Interscience, New York.

Smith, J. R. 1988. *Basic Geodesy, An Introduction to the History and Concepts of Modern Geodesy Without Mathematics.* Landmark Enterprises, Rancho Cordora, California.

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Oxford, U.K.

Deep-water rocks

Pickering, K. T., Hiscott, R. N. and Hein, F. J. 1989. *Deep Marine Environments—Clastic Sedimentation and Tectonics.* Unwin Hyman, London, U.K. Price £75 (hardback); £29.95 (paperback).

This well written book is a useful reference text, and will be a valuable addition to the shelves of many geologists. It is well referenced, richly illustrated with modern examples, and could be useful as a source text for specialist undergraduate courses in global tectonics or sedimentology. The balance of the book is clearly sedimentological, but it