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OMEGA: the Ostracod Metadatabase of Environmental and Geographical Attributes

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The term metadatabase is commonly used to refer to a database containing data about databases. In this sense it might simply be a database of, e.g., what databases exist that hold information on ostracod ecology and distribution in different parts of the world; it might contain data on who compiled the database, its geographical coverage, what file format it uses (e.g., Excel spreadsheet, Access database) and where to access it. However, it might contain more: it could include the names of taxa and the coordinates of localities, as an aid to ascertaining which of the component databases contain data on particular taxa, or to facilitate the mapping, in a Geographical Information System (GIS), of the distribution of available data. In such a case the metadatabase could become a useful research tool in its own right, as opposed to simply a convenient way of locating and accessing other databases; it would be a single database containing certain types of data, based on information gleaned from other databases. In the same way that a metapopulation (a population of populations; see, e.g., Hanski 1998) is a group of spatially discrete, physically separated populations of the same species – for example populations of an ostracod species that inhabit a series of lakes or ponds in a region – the term metadatabase (a database of databases) can be applied to a group of discrete databases of the same kind of data – e.g., regional databases of ostracod ecology and distribution. The databases themselves remain separate, but selected data from each can be compiled in a metadatabase to be visualized together and compared. For example, localities where a species has been recorded can all be plotted on a map of the world, regardless of whether the data come from a single database or many. There needs to be at least one kind of data that is common to all the databases; what other kinds of data each contains, or the overall structure of each database, are less important. In the case of a biogeographical metadatabase of living ostracods, the minimum common data to be held in the metadatabase are the coordinates of localities (to enable distributions to be mapped) and the names of taxa (to enable the distributions of species or higher taxa to be compared). Such metadatabases are already under development for, e.g., palaeolimnological data such as lake sediment cores and long-term monitoring records (Battarbee et al. 2007).

OMEGA (Ostracod Metadatabase of Environmental and Geographical Attributes) is an innovative approach to calibrating nonmarine ostracods for palaeoclimate and palaeoenvironmental applications. Ostracods are already widely recognized as valuable proxies for climate change, particularly using transfer function and shell chemistry approaches, with the focus on either aquatic (e.g., water temperature) or atmospheric (air temperature) parameters. Several methods have been established for using fossil nonmarine ostracods as Quaternary palaeoclimate proxies, using large regional databases of modern distribution as training sets, notably in Canada (e.g., Delorme 1969; Delorme et al. 1977), the USA (e.g., Forester et al. 1987; Smith et al. 2003; Curry et al. 2003) and Europe (e.g., Horne 2007; Horne & Mezquita 2008). The geographical scope of these methods can be broadened and their accuracy improved by capturing more fully the climatic ranges of taxa with geographical distributions that extend beyond the bounds of the regional databases; however, this must be accompanied by taxonomic harmonisation. Approximately 2000 species and 200 genera of living nonmarine ostracods are known world-wide (Martens et al. 2008). Several common European ostracod species have geographical ranges that extend across Asia, to the Siberian Arctic and as far as Japan. Significant numbers of species may be common to both Europe and North America; some given the same names may actually be different species, while others known by different names could actually be the same. Some species found in European Quaternary assemblages are apparently now extinct in Europe, but still live elsewhere in the northern hemisphere, for example North America or China. Such taxa have the potential to be calibrated for palaeoclimate applications by using distributional datasets from outside Europe. Similar considerations apply in the southern hemisphere, and there are examples of species which occur in both hemispheres. Such wide geographical distributions, crossing barriers such as mountain ranges and oceans, may be explained by the fact that most non-marine ostracods have resting eggs that can survive drying or freezing, facilitating long-range dispersal by vectors such as wind or migratory birds. OMEGA will facilitate global palaeoclimatological, palaeoenvironmental and biogeographical ostracod research. Contributing databases have different structures and contents. For example, the Delorme Ostracode Autecological Database, collected under the auspices of Environment Canada and curated at and by the Canadian Museum of Nature, is based on primary collections made between 1963 and 1976. It includes species identifications along with an extensive range of environmental (e.g., chemical and physical parameters) and geographic and climatic data for each of the Canadian waterbodies sampled. NANODe (North American Nonmarine Ostracode Database) is based on primary collections and includes major ion solute chemistry data for each ostracod record (Forester et al. 2005). The NODE (Nonmarine Ostracod Distribution in Europe) database is compiled mainly from published literature (Horne et al. 1998). The proposed metadatabase is readily achievable as long as each contributing database provides records comprising species names and global coordinates for localities so that they can be mapped (Fig. 1).

In this way valuable large datasets can be made available without compromising the integrity of their parent databases. As with the component databases it will be possible to visualize and analyse OMEGA datasets with a Geographical Information System. In addition to data-sharing, an essential requirement for the success of this venture will be a major programme of taxonomic revision and harmonization aimed primarily at validating the distributions of climatically-significant species.

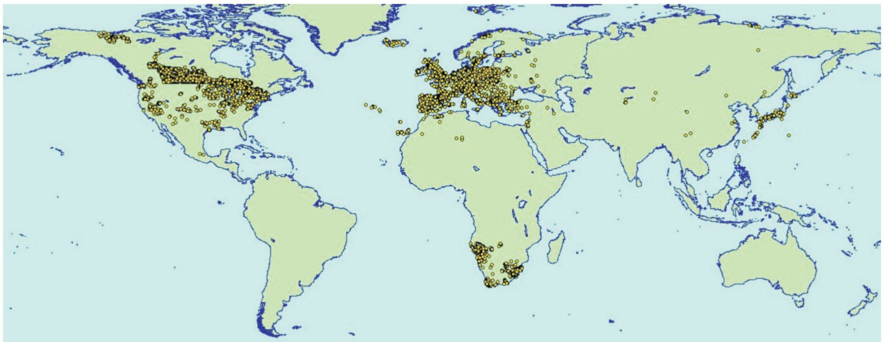

Fig. 1: Distribution of ostracod records in the Delorme, NANODe, NODE, southern African and Japan and East Asian databases.

OMEGA, which grew out of a special session during the European Ostracodologists' Meeting in Frankfurt in September 2007, will be realised through international collaboration and sharing of regional ostracod databases. Major contributors thus far (Fig. 1) include the NODE, NANODe and Delorme databases mentioned above, plus databases covering southern African (K. Martens) as well as Japan and East Asia (R.J. Smith).

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