tonic graptolites. Separate latest Cambrian–Early Ordovician local stages, the Datsonian and Warrendian, have been established in the platform sequences of the Georgina Basin, with several local stages of mainly North American aspect. When the Cambrian/Ordovician boundary is ratified internationally, it is likely to be located within the Datsonian succession. The Ordovician/Silurian boundary is recognised on an apparently continuous erosion near Darraweit Guim, north of Melbourne.

For both the Silurian and Devonian, major international decisions, defining the Period boundary, Series boundaries and Stage boundaries, have had an immediate effect on correlation of Australian sequences. In the Silurian to Early Devonian, there have been advances in the use of conodonts, with the setting up of a zonation for the most part of the Early Silurian. In the later Devonian, the standard ammonoid zones are now better correlated with conodonts, as are bryozoid zones. An analysis of recent radiometric work shows the base of the Silurian can be confidently set at 434 Ma. The Silurian boundary lies at approximately 408 Ma, but Australian data would suggest 410 Ma may be closer. Australian data also support the suggestion that the boundary with the Carboniferous lies at about 354 Ma.

For the Carboniferous, three areas — western Europe, USSR, and North America — provide standard stratigraphic scales. Of these, the scale from western Europe is most appropriate for Australian data. The Neoproterozoic Gondwanan faunas of the Early Carboniferous (i.e. Dinantian) are replaced by endemic, poorly diversified Gondwanan faunas in the Late Carboniferous. Some radiometric (K/Ar) age data from the Hunter Valley have been used to provide age estimates for Stage boundaries. The Paterson Toscante, with an average age of 308 Ma, would fall within the Westphalian C. The Visean/Namurian boundary lies at about 331 Ma at the base of the Brigantian Stage, and at 331 Ma, the Tournaisian/Visean boundary at about 342 Ma.

For the Permian, an integrated correlation chart for Australia has been prepared using isotope data and radiometric data. Following recent discussions of the Subcommission on Permian Stratigraphy at the Carboniferous Congress in Beijing in 1987, a twofold subdivision of the System is favoured. For the Lower Permian, division into Artinskian, Sakmarian, and Kungurian is recognised; for the Upper Permian, a fivefold division is used: Ufimian, Kazanian, Midian, Dzhulfian, and Changhsingian.

For the Mesozoic, preliminary compilations of fossil localities have been prepared for the Triassic, Jurassic, and Cretaceous. The available Cainozoic zonal chart (BMR Research Newsletter 8, 4-6), its distribution, and especially also where these faults intersect the (earlier) thrust faults, and the melange and shear zones that formed during one of the compressive phases. So far two types of hydrothermal alteration have been recognised: silicification, and oxidation/argillation. Silicification appears to be mostly associated with the detachment faults and steep faults that cut basement, and affects a wide range of rock types, including the basement, Cretaceous granitoids, Cretaceous to Early Eocene turbidites, etc, and the sediments and volcanics of the foreland sequence. The degree of silicification ranges from scattered quartz veins to almost complete replacement. The silicified rocks may contain epidote-clinozoisite and chlorite, but pyrite is everywhere present. Oxidation/argillation is widespread in rocks of the foreland sedimentary and volcanic sequence where displaced by normal faults. The altered rocks are off-white to light orange-brown; pyrite is oxidised to limonite forming networks of black to brown crusts. Sandstone is commonly friable and ferruginous, and the other lithologies are more or less resistant to clay. Regional-scale intrusive phases are only sporadically silicified, oxidised, or argillised, although commonly slightly propylitised.

Gold

The gold occurs in quartz veins and stockworks in the silicified zones, but it is also disseminated, some being associated with pyrite. In the oxidised/argillised rocks the gold is disseminated in clayey zones, but in friable sandstone it may form irregular coarse grains filling pores. Quartz veining is minor in zones of oxidation/argillation, but
gold is associated with pyrite and its oxidation products. The coarse gold in the sandstone is probably the product of supergene reworking and agglomeration of microscopic gold liberated from gold-bearing pyrite during oxidation.

The most common accessory ore minerals are cinnabar and stibnite. Both have been mined in small-scale operations. Base metals are notably rare or absent. So far gold has only been recovered from alluvial placers by the local people, but a vigorous exploration program for primary deposits by various mineral companies since 1982 has led to the discovery of several prospects. Although there is no apparent direct link between the Late Oligocene to Miocene shallow intrusive bodies and the mineralisation and alteration, their close spatial and temporal association suggests that the gold deposits are epithermal. The alteration also occurred when the hydrothermal fluids ascended but was not necessarily contemporaneous with the gold mineralisation. (Published with the permission of the Director, GRDC).

The shallow intrusive bodies probably supplied the heat source to initiate and sustain convection and circulation of meteoric waters. The three types of fault systems provided pathways for the upward movement of the fluids into structurally and chemically favourable horizons. Because of the structural complexity, deposition took place in a wide range of rock types. The alteration also occurred when the hydrothermal fluids ascended but was not necessarily contemporaneous with the gold mineralisation. (Published with the permission of the Director, GRDC).

The Indonesia-Australia Geological Mapping Project (IAGMP), a joint project of the Indonesian Geological Research & Development Centre (GRDC) and the BMR (under the auspices of the Australian International Development Assistance Bureau), carried out the first systematic geological and gravity mapping at 1:250 000 scale of the northern part of west and central Kalimantan between 1982 and 1986. This article covers some of the preliminary results, but for a better understanding of the controls and history of gold mineralisation and alteration much more detailed field work and research are required. Some results of the mapping are available in published form or as open-file reports at GRDC, Jalan Diponegoro 57, Bandung, Indonesia; they may be discussed with Dr Rab Sukamto or Mr Sam Supriatna at GRDC, phone (022) 73205, and Mr Peter Pieters (BMR) in Bandung at Jalan Cilik 49, phone (022) 72103.

The GOA system includes programs for producing a variety of plots (XY, triangular, histograms, and spidergrams) and calculating statistical functions (e.g., mean, standard-deviation, regression lines, correlation coefficients, and cluster analysis). Specialised petrological packages are also available and include CIPW norms and petrogenetic modelling (batch melting, Rayleigh fractionation, least-squares mixing, etc.). There are also facilities for producing hard-copy plots, tables of geochemical data, and for editing and merging datafiles. It is expected that the Fortran source code will soon be available for purchase for $750, but prospective users will also need to have Microsoft FORTRAN and Media Cybernetics HALO package for plotting routines. This system was designed to accept data from the BMR ORACLE database, but any correctly formatted ASCII data files can be used as input, or the data may be entered into files directly from the keyboard.

GDA is a comprehensive IBM PC-based whole-rock geochemical data analysis system. It is written in Fortran 77 and uses the Media Cybernetics HALO package for plotting routines. This system was designed to accept data from the BMR ORACLE database, but any correctly formatted ASCII data files can be used as input, or the data may be entered into files directly from the keyboard. The GDA system includes programs for producing a variety of plots (XY, triangular, histograms, and spidergrams) and calculating statistical functions (e.g., mean, standard-deviation, regression lines, correlation coefficients, and cluster analysis). Specialised petrological packages are also available and include CIPW norms and petrogenetic modelling (batch melting, Rayleigh fractionation, least-squares mixing, etc.). There are also facilities for producing hard-copy plots, tables of geochemical data, and for editing and merging datafiles.

It is expected that the Fortran source code will soon be available for purchase for $750, but prospective users will also need to have Microsoft FORTRAN and Media Cybernetics HALO. The price reflects the fact that no software support will be available from BMR.

For further information, contact Dr John Sheraton at BMR (Division of Petrology & Geochemistry).