Palynomorphs (spores, pollen, dinocysts, acritarchs, and algae) are microfossils that are found in marine and non-marine settings from the Precambrian to the present day.

These microfossils are geographically widespread, abundant, and readily preserved, meaning they are an excellent tool for:

- Relative age dating of rocks
- Correlating sedimentary successions
- Palaeodepositional environments
- Sequence stratigraphy
- Thermal maturity

This toolbox provides a guide to palynological analysis, from choosing a good sample through to working with palynological datasets.
Sampling

To get good biostratigraphic results, you need to start with a good set of samples.

Key factors to consider before collecting samples:

- What are the issues or questions that need resolving? What are you hoping to get from the biostratigraphic data?
- Consider lithology: it is always best to target dark-coloured mudstones or siltstones first for palynology.
- Sands and coals can still be productive, particularly with modern processing and longer acid digestion techniques.
- Sample type: outcrop, cuttings, SWC, and core are all a great source of data, each with its own advantages, and we can help to devise a sampling strategy that best suits your needs.
- The finer the sampling interval, the better the results.
- All microfossils are sensitive to high temperatures: geological processes such as volcanism can have a detrimental effect on palynomorphs so avoid sampling too close to such features.
- Drilling issues: oil-based drilling muds require more extensive washing so it is always best to provide more sample.

General rule of thumb: as grain size increases, the volume of material collected for sampling should likewise increase. With a good mudstone, only 20g of sample is required.

Having an on-site laboratory also allows for constant quality control during processing. The methodology can be tweaked as necessary to ensure the best slides possible, all at no additional cost.
It is important to be consistent when correlating palynological data. Make sure you are using the one zonation scheme for all your data, or that you clearly understand the differences between them, because there can be substantial differences as shown in the figure below.

The latest MGPalaeo zonation scheme (MGP 2014) was developed in 2014, the framework of which was built upon earlier industry standard schemes such as Morgan, Hooker and Ingram (MHI 2002), and Helby, Morgan and Partridge (HMP 1987 and HMP 2004).

MGP 2014 has been used for almost 2000 wells in our North West Shelf Stratigraphic Database to aid in consistent correlations.

Slightly modified versions of MGP 2014 exists for other basins across Australia and for Papua New Guinea, again built upon decades of work.

### Australian Middle and Late Jurassic Palynozones

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Triassic</td>
<td>AP.1s</td>
<td>Retelliaites, wathiornensis</td>
<td></td>
<td>JP6.0 SB</td>
<td>J30</td>
</tr>
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<td>Triassic</td>
<td>AP.1s</td>
<td>Retelliaites, wathiornensis</td>
<td></td>
<td>J56.0 SB</td>
<td>J50</td>
</tr>
<tr>
<td>Jurassic</td>
<td>AP.1s</td>
<td>Retelliaites, wathiornensis</td>
<td></td>
<td>J54.0 SB</td>
<td>J50</td>
</tr>
<tr>
<td>Jurassic</td>
<td>AP.1s</td>
<td>Retelliaites, wathiornensis</td>
<td></td>
<td>J53.0 SB</td>
<td>J40</td>
</tr>
<tr>
<td>Jurassic</td>
<td>Jurassic</td>
<td>Murospora flandra</td>
<td></td>
<td>J47.0 SB</td>
<td>JK</td>
</tr>
<tr>
<td>Jurassic</td>
<td>Jurassic</td>
<td>Murospora flandra</td>
<td></td>
<td>J47.0 SB</td>
<td>JK</td>
</tr>
</tbody>
</table>

**Notes:**

- Pseudocostatum alsacei
- Diplocostatum petrae
- Diplocostatum petrae
- Chirosporidium petrae
- Omata montgomeryi
- Omata montgomeryi
- Omata montgomeryi
- Omata montgomeryi
- Omata montgomeryi
- Omata montgomeryi
- Omata montgomeryi
MGPalaeo’s palynological reports will contain a zonation scheme explaining which zonation is being used, a summary table listing the details for each sample, simple text description of the key diagnostic features of each zone, and a StrataBugs chart.

The summary table (below) lists the confidence level, spore-pollen colour, zonal pick, depositional environment, and key species of each palynology sample.

### Palynological Reports

<table>
<thead>
<tr>
<th>Depth (mbrT)</th>
<th>Sample Type</th>
<th>Microfossil Yield</th>
<th>Preservation</th>
<th>Depth (mbrT)</th>
<th>Sample Type</th>
<th>Microfossil Yield</th>
<th>Preservation</th>
<th>Percentage</th>
<th>Spore-Pollen Colour</th>
<th>Zone</th>
<th>Environment</th>
<th>Key Datums</th>
</tr>
</thead>
<tbody>
<tr>
<td>1120 / 1130</td>
<td>CUTTS</td>
<td>Very high</td>
<td>Good</td>
<td>25</td>
<td>&lt;1</td>
<td>16</td>
<td>59</td>
<td>Very High</td>
<td>M. australis - M. testudinaria</td>
<td>Nearshore marine</td>
<td>P. neocomica, M. australis, S. attadalense, D. cerviculum</td>
<td></td>
</tr>
<tr>
<td>1160 / 1170</td>
<td>CUTTS</td>
<td>Very high</td>
<td>Good - Moderate</td>
<td>20</td>
<td>&lt;1</td>
<td>11</td>
<td>69</td>
<td>Very High</td>
<td>Orange-brown</td>
<td>Nearshore marine</td>
<td>P. burgeri, S. tabulata, P. burgeri, M. testudinaria, M. australis</td>
<td></td>
</tr>
<tr>
<td>1180 / 1190</td>
<td>CUTTS</td>
<td>Low Moderate</td>
<td>Moderate</td>
<td>13</td>
<td>&lt;1</td>
<td>16</td>
<td>71</td>
<td>Low Moderate</td>
<td>Orange-brown</td>
<td>Nearshore marine</td>
<td>S. areolata, C. magna</td>
<td></td>
</tr>
<tr>
<td>2000 / 2010</td>
<td>CUTTS</td>
<td>Low Moderate</td>
<td>Moderate</td>
<td>27</td>
<td>0</td>
<td>8</td>
<td>65</td>
<td>Low Moderate</td>
<td>Light Brown</td>
<td>Nearshore marine</td>
<td>W. indotata, S. tabulata, P. burgeri, M. testudinaria, M. australis</td>
<td></td>
</tr>
</tbody>
</table>

Allows for an indication of the confidence level for that sample (e.g., low yields of poorly preserved microfossils might indicate low confidence in the results for that sample, while high yields of well preserved species could indicate higher levels of confidence).

Zonation age based on MGP 2014.

Broad environmental subdivisions giving a general impression of proximity to shoreline.

Spore-Pollen Colour | Zone | Environment | Key Datums |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange-Brown</td>
<td>M. australis - M. testudinaria</td>
<td>Nearshore Marine</td>
<td>P. neocomica, M. australis, S. attadalense, D. cerviculum</td>
</tr>
<tr>
<td>Orange-Brown</td>
<td>P. burgeri</td>
<td>Nearshore Marine</td>
<td>P. lowii, S. tabulata, P. burgeri, M. testudinaria, M. australis</td>
</tr>
<tr>
<td>Orange-Brown</td>
<td>P. burgeri or older</td>
<td>Nearshore Marine</td>
<td>S. areolata, C. magna</td>
</tr>
<tr>
<td>Light Brown</td>
<td>W. indotata or younger</td>
<td>Nearshore Marine</td>
<td>W. indotata, S. tabulata, P. burgeri, M. testudinaria, M. australis</td>
</tr>
</tbody>
</table>

Guide for determining thermal maturity, which in turn can be related to hydrocarbon generation. With increasing temperatures and pressures, the fossil colours change from yellow (immature) through to black (post-mature).

Key species used to define the zonal age.
Some points to keep in mind with regards to Zones/Subzones listed on the summary table:

- **Ranged zonation age** (e.g., *M. australis* – *M. testudinaria*): indicates that the sample didn’t contain a good enough assemblage of fossils to be able to confine it to a single zone, but it did contain enough to limit it to a range of zones.

- **A zonal assignment with a question mark before it** (e.g., ?*P. burgeri* Zone): indicates this is the best zonation estimate based on the evidence at hand.

- **Zonal age ‘or older’** (e.g., *P. burgeri* Zone or older): the sample only contained enough fossils to indicate that it can’t be any younger than the zone mentioned. However, there isn’t enough evidence to restrict it to this zone; it could be a little older, or a lot older.

- **Zonal age ‘or younger’** (e.g., *W. indotata* Zone or younger): the sample only contained enough fossils to indicate that it can’t be any older than the zone mentioned. However, there isn’t enough evidence to restrict it to this zone; it could be a little younger, or a lot younger.

**Species Abundance**

- TOP? Or reworked?
- TOP CONSISTENT
- TOP COMMON
- ACME (= PEAK)
- BASE COMMON
- BASE CONSISTENT
- BASE? Or caved?

**Key terms used in defining the geological range of a microfossil.**
Distribution Charts

StrataBugs charts illustrate the microfossil content of each sample in stratigraphic order.

The main components of a StrataBugs chart as shown on the figure below are:

- **Header**: main background text for the well.
- **Key**: has the unplaced text and sample types that can’t fit on the actual chart.
- **Biozone**: indicates which zones are being used (dinocyst zones and/or spore-pollen zones).
- **Sample and Analyst**: important when multiple vintages of data and mixed sample types are used. Details who carried out the work on each sample.
- **Alphabetic Key**: helps to locate a particular fossil species as most times, the fossils are displayed in the chart in order of their first downhole occurrence.
- **Panel Headers**: indicates if absolute or relative abundances have been used.
- **Total Count**: shows the total number of palynomorphs counted for each sample (generally, a count of 200 fossils per slide is carried out, with a scan of the rest of the slide to record any key markers that might be present). It is important to identify the lean samples.
- **Category**: useful to see what the dominant palynomorph groups are.
- **Individual Species Counts**: indicate the number of specimens of a particular species recorded in each sample. Where there is a question mark, it means only a questionable specimen was recorded, and where there is a ‘+’ that means a particular species was recorded but outside of the count.
Further Information

MGPalaeo also offers a comprehensive range of sedimentological services, leading to a better understanding of stratigraphic development and depositional models. These include:

- Core description and Reporting
- Image Log Interpretation
- Core workshops
- Wireline log interpretation
- Rock Typing from cuttings
- Sidewall core descriptions

For further information regarding how we can help you, please don’t hesitate to contact us at info@mgpalaeo.com.au.

Our website: www.mgpalaeo.com.au

We’re also happy to help advise on sampling programs for all new wells or review projects.