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The majority of Australia's hydrocarbon reserves have been generated from source rocks containing non-marine organic matter. Terrestrial organic matter consists of a mixture of hydrogen-rich and hydrogen-poor components. Hydrogen-rich components include cuticle, spores, suberin, and resin, and are capable of generating oil on maturation, whereas the structural parts of plants (wood, etc) are hydrogen-poor and produce only gas on maturation. The mix of these components depends, in part, on the type of plant that supplied the organic matter, and may be related to the evolutionary stage of the land plants. Mesozoic and Tertiary floras in Australia appear to have produced a greater abundance of hydrogen-rich cuticle, suberin, and resin components compared with their Permian counterparts. A second control is the depositional environment. Deposition of terrestrial organic matter in a mildly oxidising, aquatic environment results in fungal and bacterial degradation of wood and cellulose, and the concentration of hydrogen-rich components. Approximately 20 to 30% of hydrogen-rich components are required for terrestrial organic matter to be a source for oil. Oil generation from terrestrial organic matter occurs at vitrinite reflectance levels above 0.7% Ro, except where resin is a major component, when oil generation can occur at reflectance levels as low as 0.5% Ro. Gas generation is significant at reflectance levels above 0.55% Ro, and entrainment of liquid hydrocarbons in the gaseous phase means that condensate can be included in gas at all stages of maturation.

Most oils from terrestrial sources are paraffinic and may have a high wax content. The wax content is extremely variable and is favoured where depositional conditions result in the concentration of hydrogen-rich components in the source. Resin contributes a variable amount of naphthenic and aromatic oils and condensates. High pristane to phytane ratios (>3.5) and a high proportion of acyclic isoprenoids are typical of most terrestrial source oils, but those extremely waxy oils formed in lacustrine environments may have lower values. The importance of microbial processes in the formation of the source organic matter for non-marine oils is shown by the presence in the oils of a variety of hydrocarbons derived from bacterial precursors. The overall composition and isotopic composition of gases formed from terrestrial organic matter are extremely variable and poorly understood.