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The Time that Geology Forget – What Dykes in the Sydney Basin tell us about the Volcanic Evolution of the East Australian Continental Margin.

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Doleritic to basaltic dykes ranging in width from centimeters to several meters and with strike lengths tracing up to several kilometers on the mainland intrude the sedimentary country rocks of the Sydney Basin. Published coastline mapping suggests a higher prevalence of dykes than have been discovered within the Basin proper. The limited intersections of dykes away from the coast is likely due to the dense coverage of urban development in greater Sydney and that few dykes intersected in excavations and tunnels have been publicly documented. Published dyke orientations suggest two dominant sets – an east-west trending set and a north-east trending set that parallels the dominant fault/joint trend in the Basin. Additional dykes specifically related to diatreme intrusion are also present. This paper presents a review of the dyke orientations in the Sydney Basin with a view to investigate possible magmatic origins. Evidence collected from a 3D exposure of the Greenacre dyke indicates the magmatic source was located towards the coast, possibly offshore. The orientation of this dyke, dykes presented on the Sydney 1:100 000 geological sheet and other published or mapped dykes were traced to see if they coalesced to a single origin, indicative of the magmatic source. The result was multiple dykes radiating from a series of point locations, locations that align along the remnants of the Gerringong Volcanic Ridge, some 10 to 20 km off the present Sydney coast line. This volcanic arc was active in the late Permian, through to the early Triassic. Age dating of the dykes infers a Jurassic age, a period that coincides with a gap in the stratigraphic record of the Basins sedimentary sequences. Apatite fission track studies suggest the Basin was buried some 2.5 to 3km deeper than present during the Jurassic before later uplift and erosion to its present position. This paper discusses the possibility that the Gerringong Volcanic Ridge was reactivated during the Jurassic and is the source of the intrusive dykes. It discusses whether the heat and pressure generated by 3km burial depth was sufficient to have reactivated the inactive magmatic source, but prevent extrusive volcanism. Evidence from the Greenacre dyke is presented that indicates the country rocks were in a semi-ductile phase during intrusion and how this relates to the depth of Basin burial at the time. The overall structural history of the Sydney Basin is discussed to counter post-intrusion reorientation of dykes as an explanation for their present alignments.