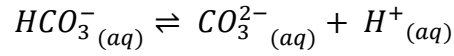


## **Appendix 1**

The second ionisation of carbonic acid is represented by the system



The equilibrium constant for this reaction ( $K_{a2}$ ) is a function of the balance of the ions at equilibrium

$$A1) \quad K_{a2} = \frac{aCO_3^{2-}(aq) aH^+(aq)}{aHCO_3^-(aq)} = \frac{[CO_3^{2-}](aq)}{[HCO_3^-](aq)} \cdot \frac{10^{-4A\sqrt{I}}}{10^{-A\sqrt{I}}} \cdot aH^+(aq)$$

Where A is a Debye-Hückel parameter. As  $-\text{Log}_{10} aH^+(aq) \equiv \text{pH}$

$$A2) \quad -\text{Log}_{10} K_{a2} = -\log_{10} \left\{ \frac{[CO_3^{2-}](aq)}{[HCO_3^-](aq)} \right\} + 3A\sqrt{I} + \text{pH}$$

By rearrangement, therefore

$$A3) \quad [CO_3^{2-}](aq) = K_{a2} [HCO_3^-](aq) 10^{3A\sqrt{I} + \text{pH}}$$

## **Appendix 2**

Compilation of field data for the analyses presented in this manuscript.