SUPPORTING INFORMATION

Synthesis and Transformation of Calcium Carbonate Polymorphs with Chiral Purine Nucleotides

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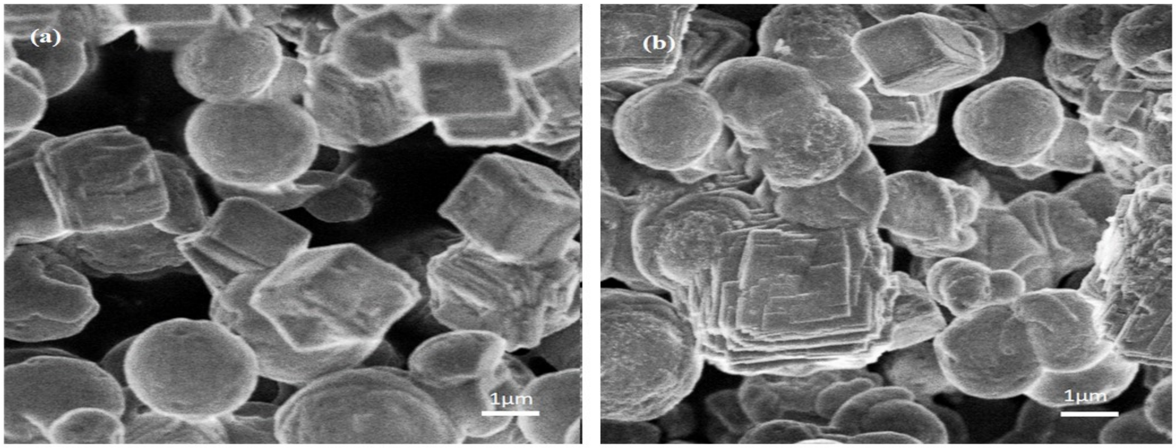

Fig. S1 SEM images of mixed polymorphs of calcium carbonate in the absence of purine nucleotides **(a, b)**.

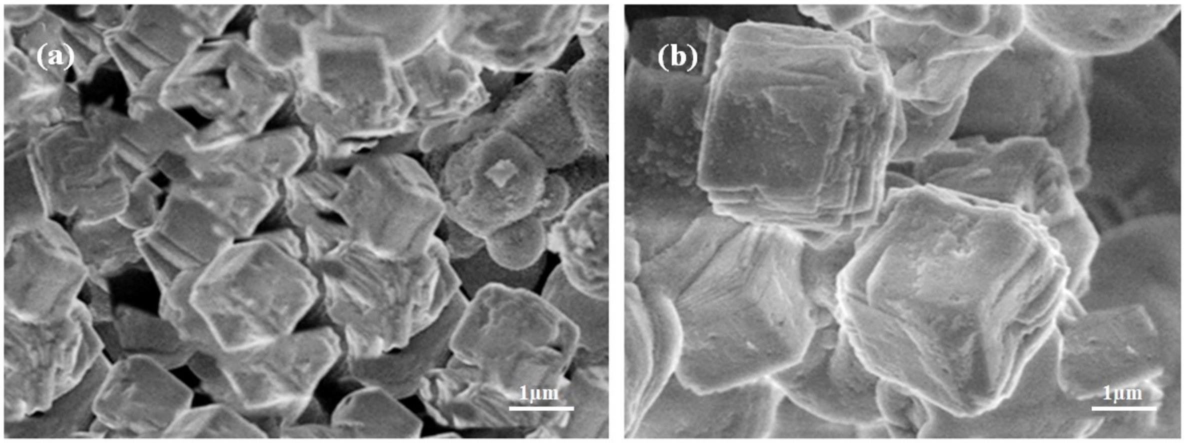

Fig. S2 SEM images of cubic calcite polymorph of calcium carbonate with purine nucleotides in the presence of ATP **(a)** and in the presence of GTP **(b)**.

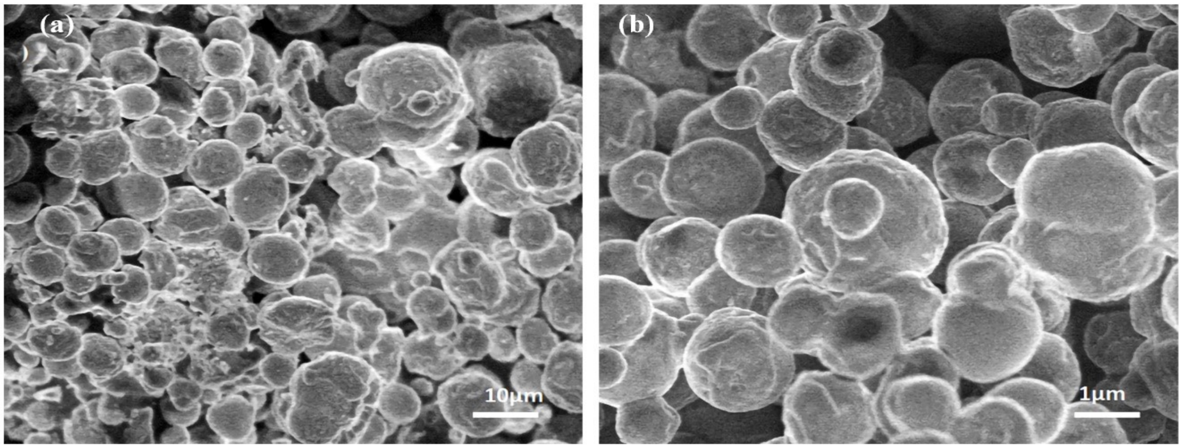

Fig. S3 SEM images of spherical vaterite polymorph of calcium carbonate with purine nucleotides in the presence of ATP **(a, b)**.

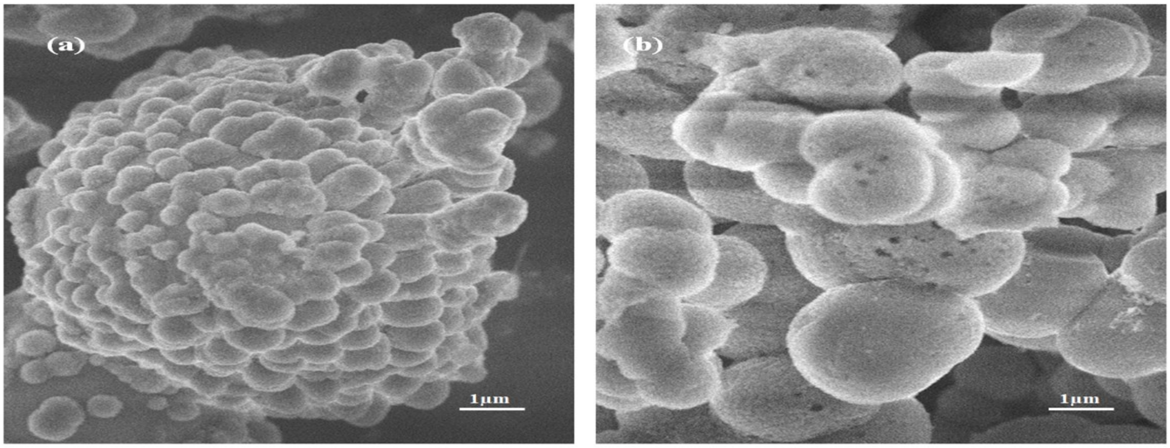

Fig. S4 SEM images of spherical vaterite polymorph of calcium carbonate with purine nucleotides in the presence of GTP **(a, b)**.

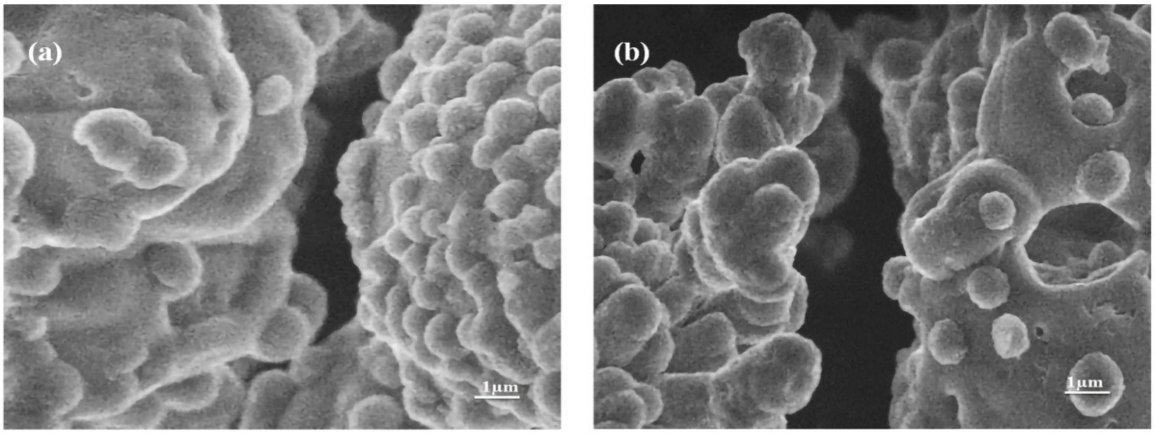

Fig. S5 SEM images of spherical vaterite polymorph of calcium carbonate with purine nucleotides in the presence of GTP **(a, b)**.

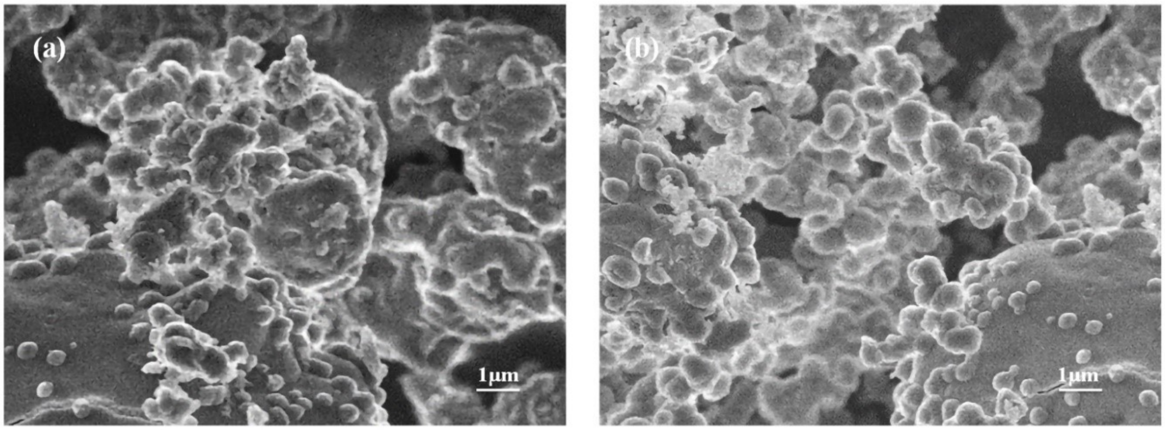

Fig. S6 SEM images of spherical vaterite polymorph of calcium carbonate with purine nucleotides in the presence of GTP **(a, b)**.

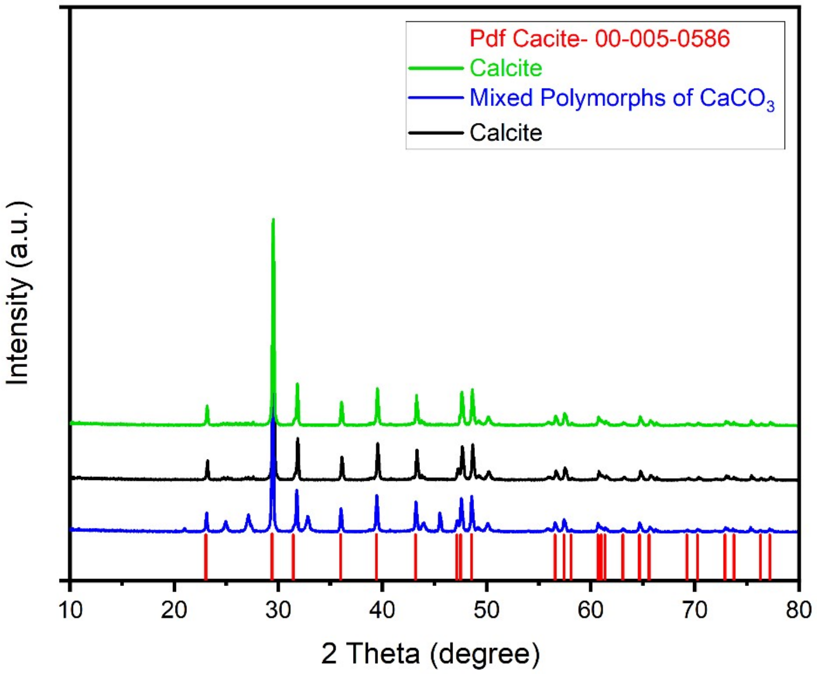

Fig. S7 PXRD pattern of Calcite in the presence of nucleotides (ATP, GTP) and mixed polymorphs in the absence of nucleotides compared with pdf card of calcite.

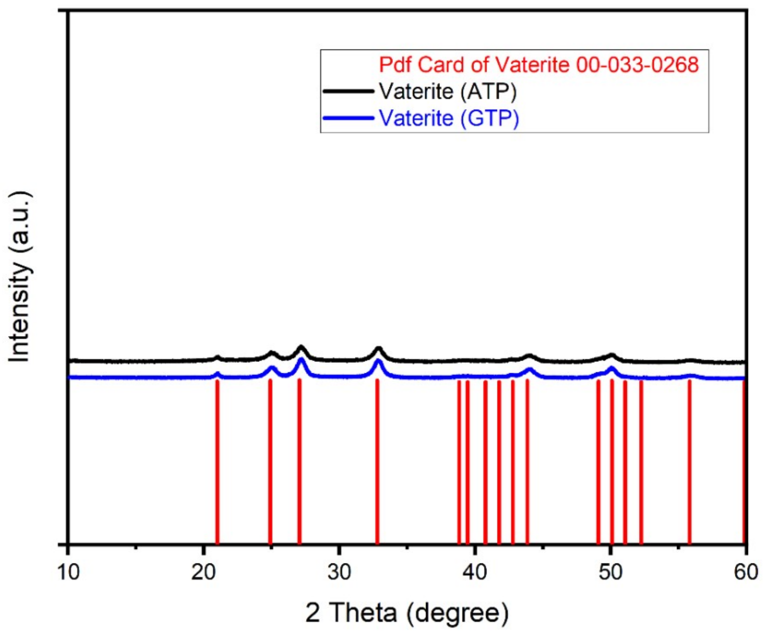

Fig. S8 PXRD pattern of vaterite in the presence of nucleotides (ATP, GTP) compared with pdf card of vaterite.

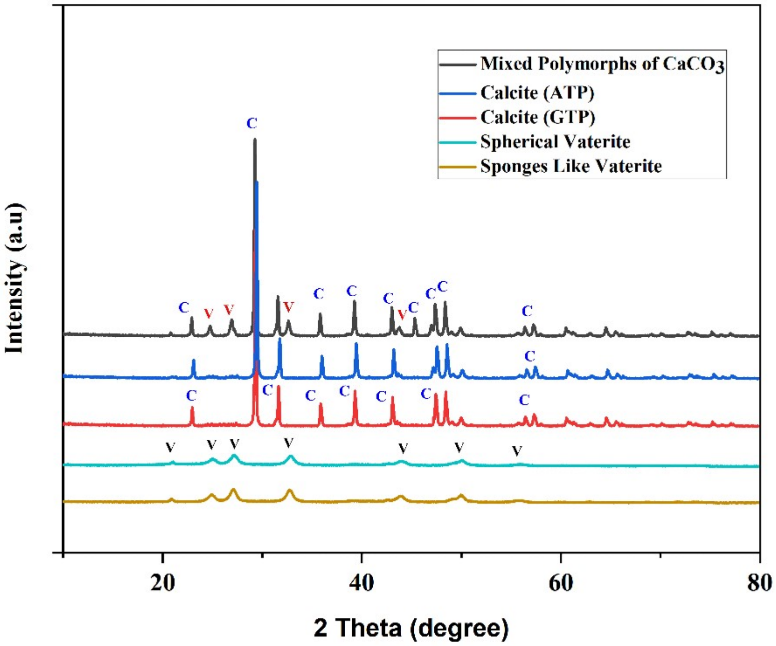

Fig. S9 PXRD pattern of all the smples of calcite and vaterite in the presence of nucleotides (ATP, GTP).

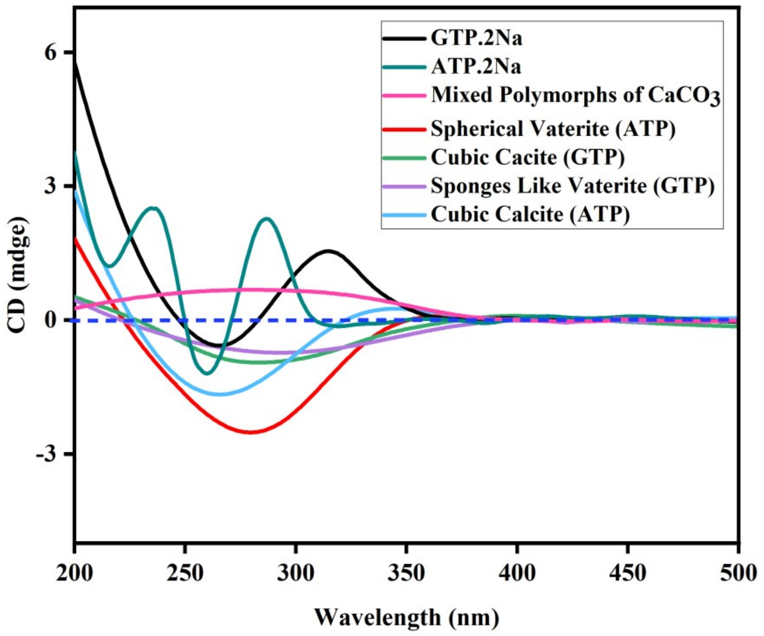

Fig. S10 Scattering CD signals were produced by the different structures (spherical vaterite and sponge vaterite) of calcium carbonate, while the absorption-based CD was produced by the various morphologies of calcium carbonate in the spherical and sponge-like structures. The CD spectra show that calcium carbonate is transforming from calcite into vaterite as well as from achiral to chiral calcium carbonate in the presence of purine nucleotides ATP and GTP.

The coordination number of calcium ion (Ca^{2+}) increases from 6 in calcite to 9 in aragonite and 12 in vaterite, followed by increased purine ligand Which increases the stability of vaterite polymorphs. Calcite, the most stable form, is present in the human ear. They have intrinsically heterogeneous structures, both in terms of surface and bulk composition. Metal cation and anion exchange can change their composition over long timeframes. Polymorphs with the same chemical makeup but various packing configurations might have distinct biological features (for example, calcium carbonate crystals in the inner ear) [1-2]. Chiral biominerals in the form of nanomaterials have strong chiroptical activity, enantioselectivity, catalytic activity, and biocompatibility to complement their multiscale chiral morphologies/geometries and structural variety. Chiral biomineral construction with different morphologies has biological applications, and optical/electronic devices are anticipated to be the focus of future research in this field.

We have emphasized the need of expanding research into the biological and medicinal chemistry of minerals since they have the potential to uncover illness causes and provide opportunities for the development of innovative medicines, chiroptical materials, ceramic as well as biotechnology applications.

References:

1. J. Fan, N.A. Kotov, Chiral nanoceramics. Advanced Materials 32 (2020) 1906738.
2. J. Wenge, Y. Xing, M.D. McKee. Chiral biomineralized structures and their biomimetic synthesis. Materials Horizons 10 (2019) 1974-1990.