



Fossils in Art and Science Guidance for Research, Education and Communication

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Abstract: The article provides author's perspective on the role and significance of fossils not only in science but also in art, education and communication and illustrates how fossils recreate ancient environments with evolutionary processes. For artists working at the intersection of science and culture, fossils can be material witnesses and records of deep time environments and organismal behavior. Figures contain representations to better understand, and face challenges associated with fossils. Fossil inclusions are found in amber and fossiliferous limestones. The study provides information on how fossils are implicated in art and science by addressing the origin of fossil amber inclusions, origin of limestone fossil inclusions and bone fossilization, role of amber and fossil inclusions in cultural representations, amber inclusions as representative of the migration, diversity and coexistence with possible interactions between different species shaping fossil environments, paleoart as artistic work representing prehistoric life based on scientific evidence, and fossils in education. These multiple interdisciplinary approaches can be integrated to obtain information for a better description and analysis of the origin and evolution of modern organisms and their environments. The research and communication of fossils increase our perspective of the world inspired by science, art, nature, and new ideas to face modern challenges.

Keywords: art; communication; education; evolution; fossil

1. INTRODUCTION TO FOSSILS

The scientific definition of fossil is the “evidence of life preserved in a geologic context” (National Park Service; [https://www.nps.gov/subjects/fossils/what-is-a-fossil.htm#:~:text=Fossil%20\(noun\):,much%20more%20narrow%20and%20specific](https://www.nps.gov/subjects/fossils/what-is-a-fossil.htm#:~:text=Fossil%20(noun):,much%20more%20narrow%20and%20specific)). The fossils provide evidence of life with information about remains of living organism in plants, animals, and microorganisms or some sort of trace or mark of an organism that have lived on Earth throughout geologic time. Accordingly, fossils include bones, footprints and coprolite of dinosaurs, shark teeth, mammoth tusks, ammonites and the remains of microscopic organisms or grains of pollen to organic molecules or chemical signatures left by ancient life. Fossils also include petrified wood and ichnofossils such as the seafloor trails of organisms such as trilobites. Fossils entrapped in amber include inclusions such as arthropods, plants and animal remains.

The study of fossils is relevant to provide information about the history of life on Earth, and its evolution through the ages. The characterization of the fossil record provides information to understand the diversity of life on Earth through evolution and extinction processes. Earliest book on fossil studies is considered De Rerum Fossilium published in 1565 by Conrad Gesner with detailed descriptions and drawings of fossil remains. Other books include (a) Natural History of Oxfordshir by Robert Plot published in 1677 with dinosaur bone representation (<https://www.oum.ox.ac.uk/learning/htmls/plot.htm>), (b) Foundational Paleontology by Georges Cuvier published in 1812 with evolutionary study of fossils and (c) Creatures of other days. Popular studies in Paleontology by Rev. H.N. Hutchinson,

author of “Extinct Monsters”, edition in English, published by Chapman and Hall, LD., London in 1896 with numerous illustrations by J. Smith and others.

Fossils have also a significant role in art and artistic representations, education, communication and traditional medicine (Cervato and Frodeman 2012, Dahlstrom 2014, Evagrou et al. 2015). Leonardo da Vinci (1452-1519), a reference in art and science, made important contributions to paleontology with contributions in the study of body and trace fossils, evolution and connection with art (Black 2010). Taken together, research and communication of fossils increase our perspective of the world inspired by science, art, nature, and new ideas to face modern challenges.

2. ORIGIN OF FOSSIL AMBER INCLUSIONS

The results of molecular paleontology guide the study of the origin of fossil amber inclusions (Grimaldi 2019, Greshko 2023, Pańczak et al. 2024) (Fig. 1). Amber originates from sticky terpene resin exuded by coniferous trees in which organisms (mainly arthropods but also plants and vertebrate parts) get trapped in the fresh resin. Then, the resin with inclusions falls to the ground and gets covered by sediment in environments such as riverbeds and lagoons. At copal stage, the resin polymerizes with heat and pressure and harden into copal. From resin origin to copal stage, other inclusions may appear such as microorganisms (e.g., environmental bacteria) and aquatic organisms. Fossilization of the copal then occurs during more than 40,000 but mostly during millions of years by pressure, heat, oxidation and removal of essential oils to produce the hard and stable amber with inclusions.

Arthropods associated with fossil environments are common, but plant and vertebrate remains such as feathers and lizard feet bone and snail are rare. Gram-negative Enterobacteriaceae can be identified in amber and introduced likely during fossil formation. *Kluyvera* sp. and *Serratia* sp., are found in water, soil, plants and sewage and some species are opportunistic pathogens in humans (Yu 1979, Rodriguez and Gutkind 2024). The East China marine sediment, *Shimia sediminis* sp. nov., is also a Gram-negative bacterium but strictly aerobic (Zhu et al. 2021). The Pacific coast of Asia oyster, *Magallana gigas*, is the modern species of its fossil ancestor, *Crassostrea gigas*, appearing in the Jurassic period (Ullmann et al. 2013).

These findings suggest that during amber formation, multiple arthropods and vertebrate remains got trapped and preserved as inclusions for millions of years while environmental bacteria and aquatic organisms contributed trace fossils as inclusions and paleoproteins (de la Fuente et al. 2026).

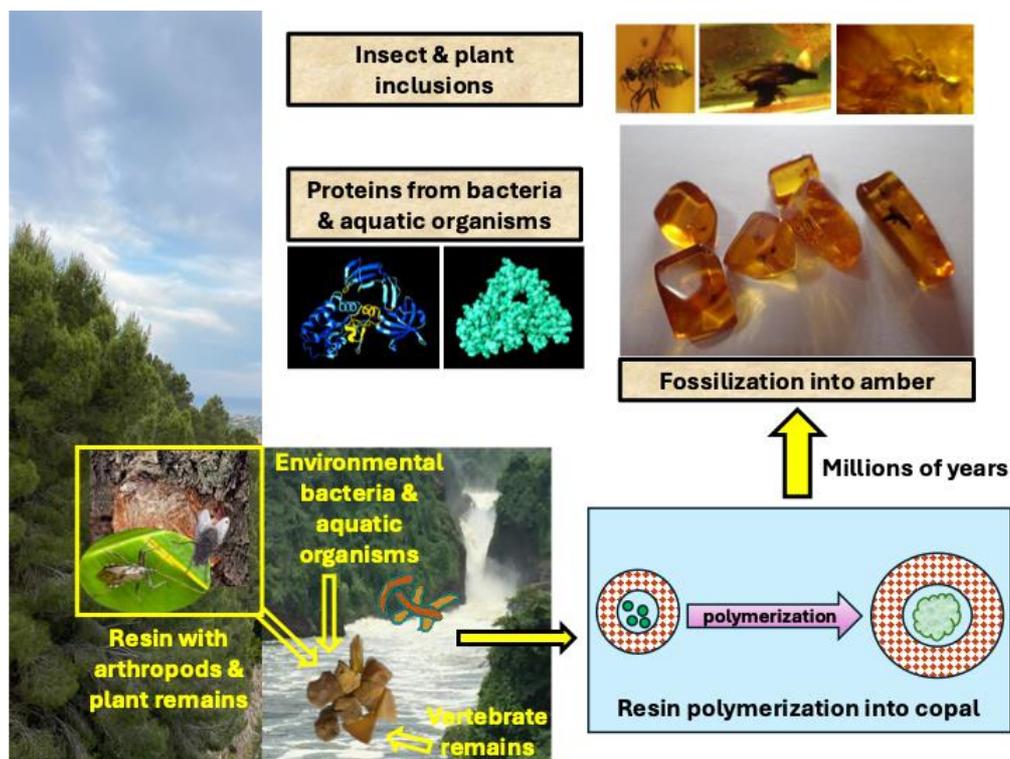


Figure 1. Amber inclusions fossilization process. Amber originates from tree resin with trapped inclusions. The fossilization process during millions of years results in amber with inclusions and

paleoproteins. Fossil amber pieces are from Baltic region, Poland (Eocene, 38-54 Mya). The structure of the Elongation factor 1-alpha (A0A2H4RIF7_9ACAR) identified in Neothyridae gen. sp. (Villar et al. 2025) was modeled with <https://neurosnap.ai> (Boltz-2 AlphaFold3).

3. ORIGIN OF LIMESTONE FOSSIL INCLUSIONS AND BONE FOSSILIZATION

Limestone fossil inclusions mainly contain preserved seafloor skeletal remains and waste products of marine organisms such as shells, corals, ammonites and fish skeletons, but also other organisms such as plants and insects. The main source of fossil limestones is marine life such as algae, clams, corals, snails, starfish, sea urchins, and microscopic organisms and are mainly composed of calcium carbonate from their shells and skeletons in compacted hard rocks. As described by EBSCO Knowledge Advantage - Limestone (<https://www.ebsco.com/research-starters/chemistry/limestone>), “Limestones form in one of three ways: chemical precipitation of crystalline grains, biochemical precipitation and accumulation of skeletal and nonskeletal grains, or accumulation of fragments of preexisting limestone rock. Chemical precipitation occurs when the concentration of dissolved calcium carbonate in water becomes so high that the calcium carbonate begins to come out of solution and form a solid, crystalline deposit. The concentration of calcium carbonate in the water may change for a number of reasons. For example, evaporation, increase in water temperature, influx of calcium or carbon dioxide, and decreasing acidity can all cause precipitation. Crystalline limestone forms in the ocean, in alkaline lakes, and in caves, and also as a precipitate in arid climate soils—a variety known as caliche”. The shells and skeletal remains get preserved in the limestones as fossils reflecting ancient life and environment (Fig. 2).

Fossil bones and teeth from ancient animals were preserved by rapid burial in sediment mud, sand or ash that hardened into sedimentary rock through permineralization or petrification for millions of years. In this process, marine environments are also good for preservation. The geological forces then bring the rock to the surface and weathering processes with wind, water and ice get the fossil exposed on the surface (Fig. 2). Alternative preservation methods of fossil bones include mold and casts when the original bone dissolves leaving a cavity (mold) that fills with minerals to form a copy (cast) and freezing when organisms trapped in ice are well preserved.

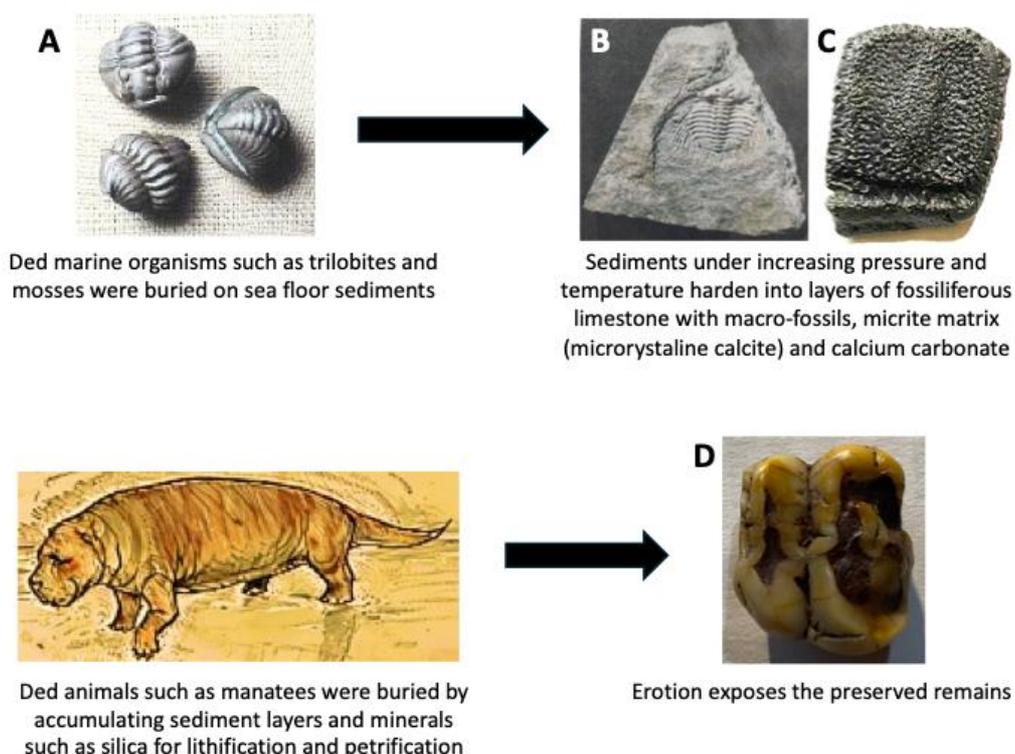


Figure 2. Formation of limestones and fossils. (A) Trilobites, *Flexicalymene meeki*, Ohio, USA, Ordovician. (B) Trilobite, *Leonaspis (Odontopleura sp.)*, Upper Icia Lutita, La Paz, Bolivia, Devonian. (C) Bryozoan. Aquatic moss, North America, Carboniferous. (D) Manatee fossilized tooth. Distinct multi-cusped crown unlike natural mineral habits. North America, Pleistocene.

4. AMBER AND FOSSILS IN MEDICAL INTERVENTIONS AND CULTURAL REPRESENTATIONS

Amber fossilized tree resin has been used in multiple cultures by inspiring medical interventions with paleopharmaceuticals (chemical compounds found in amber) and cultural representations (de la Fuente 2023a, 2025a, 2025b).

Amber inspires medical interventions as used in traditional Chinese medicine and Feng Shui for its role in harmonizing individuals with environmental factors and healing properties (de la Fuente 2025a). As described by de la Fuente (2025a), amber extracts have been used as a diuretic, enhancer of mental stability, bleeding stop, wound healer, to prevent and reduce allergic, neurotoxic and inflammatory effects, and to suppress melanin production, promote collagen production, reduce fat accumulation, and in folk medicine.

Fossil bones are also used in Chinese traditional medicine. Usually, fossils are ground up and resulting fine powders are added to herbs, animal remains, seeds and fruits for local remedies applied to different ills such as tummy upsets, headaches, colds and flu.

As a symbol of prosperity, amber is used in decorations and jewelry (de la Fuente 2023a, 2023b, 2025a, 2025b, 2025c) and linked to artistic representations particularly in surrealism (Camacho and Arrabal 1987, de la Fuente 2025d, 2025e). For example, the artist Jorge Camacho (Havana, Cuba, 1934 – Paris, France, 2011), a reference of Surrealism (Camacho and Arrabal 1987, de la Fuente 2025e), represents insects and other animals in his pieces inspiring connection with amber fossil inclusions (Fig. 3A).

In decoration and jewelry, amber from different origin (e.g., Eocene, 38-54 million years ago (Mya) and Miocene-Oligocene, 5-38 Mya) are used as a material in multiple pieces (Figs. 3B-3E). A painting with Baltic amber chips gives a 3-D effect to accentuate the components of a landscape (Fig. 3B). Insect representations in jewelry are found using both amber material as shown in a Mexican 925 sterling silver brooch (Fig. 3C) and a fossil inclusion in a Lithuanian amber and silver pendant (Fig. 3D). Additionally, amber is used to decorate animal representations such as a hippopotamus made with amber and silver and representing a symbol of strength, resilience, balance, maternal protection and life (Fig. 3E).

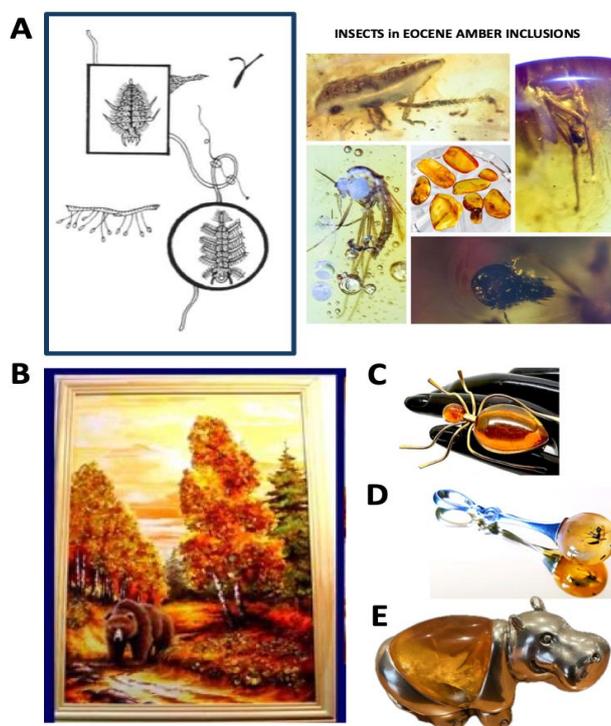


Figure 3. Amber and fossil inclusions in different cultural representations. (A) Jorge Camacho. Insect surrealist representations may be linked to insects in Baltic amber inclusions (Eocene, 38-54 Mya). (B) Painting with Lithuanian Baltic amber chips (29 x 20 cm, Eocene, 38-54 Mya). (C) Ant representation in a Lithuanian 6K gold-plated Art Deco brooch with Baltic amber (Eocene, 38-54 Mya). (D) Insect inclusion (10 x 8 mm) in a Lithuanian fossil amber (Eocene, 38-54 Mya) and silver pendant. (E) Hippopotamus (9 x 6 x 4 cm) with Baltic amber (Eocene (38-54 Mya) and silver.

Not only amber fossil inclusions but also fossiliferous limestones and bones can relate to artistic representations for different purposes (Figs. 4A-4K). Wifredo Lam (Sagua La Grande, Cuba, 1902 – Paris, France, 1982) is one of the best-recognized surrealist artists who approached Afro-Cuban cultural representations and previously connected with science and biomedicine (de la Fuente 2018, 2024). The “egg” piece by W. Lam (Fig. 4A) inspires connection with a trilobite inside a round stone concretion which provides a high preservation quality (Fig. 4B). Lam porcelain plate with a fish representation (Fig. 4C) is then connected with American marine fossils (Figs. 4D, 4E). The Turrítella Agate is prepared for healing therapies (Fig. 4F). Other well preserved limestone inclusions inspire cultural representation of the fossil organisms such as dinosaur (Figs. 4G, 4H) and mammoth (Figs. 4I, 4J).

Gastropod Turrítella Agate is also known as Elemia Agate and comes from Eocene Green River Formation (Allmon 2011) (Fig. 4F). Using Turrítella Agate Meanings and Uses (<https://www.crystalvaults.com/crystal-encyclopedia/turritella-agate/?srsltid=AfmBOopdhAWY--EM9KKxB6JlmNB-QwjJ9pG3muTo37ZcMpKeNXvPVSPS>) as a reference, Turrítella Agate is considered a spiritual crystal found in artefacts of Neolithic people. It is deeply connected to the earth, home, and family as a symbol of strength, protection and healing. Agate medicinal applications include physical, emotional healing and expanded from the ancient Greek and Egyptian civilizations to Africa, Middle East, Russia and Germany with records from the 15th century to the present.

Fossil bones are also used in decorative art such as scrimshaws with etching designs and rubbing in pigments such as lampblack to highlight the patterns (Fig. 4K). This folk art has historical significance and is particularly associated with 19th Century sailors and whalers. The engraved whale and ship are characteristic of scrimshaw craft.

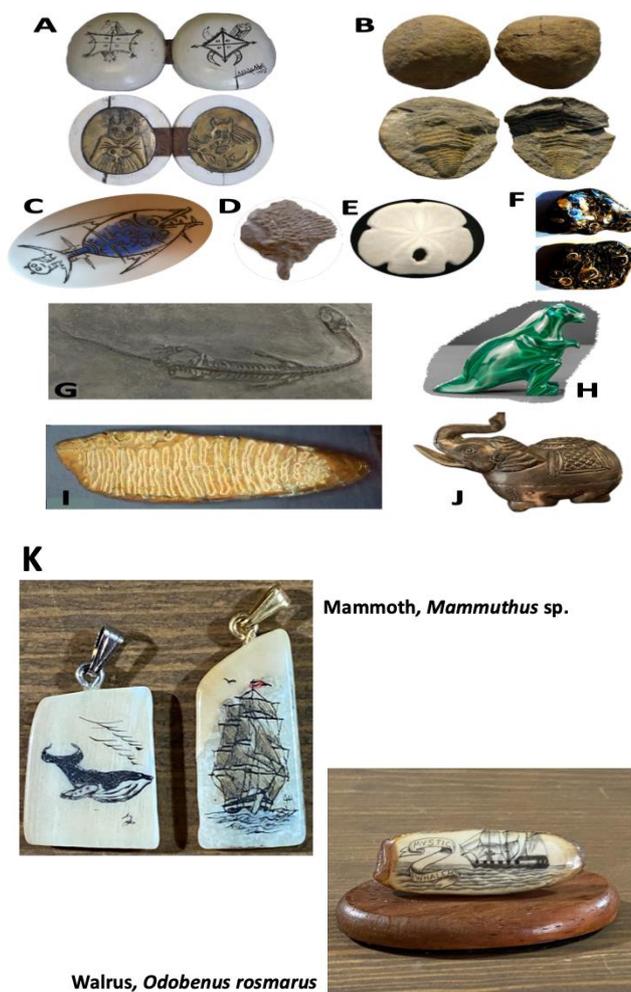


Figure 4. Cultural-scientific interconnection between art and fossiliferous limestones and bones. (A) Wifredo Lam. No title. Wood, painting and bronze, 17.7 x 20.3 cm. Havana, Cuba, 1945. Hand signed. Reference (de la Fuente and García Yero 2025). (B) Trilobite, *Paciphacops campbelli*, North America, Devonian, 358-419 Mya. (C) Wifredo Lam. Porcelain tableware from Royal Selb Bavarian, Germany with screen printing at Fabrica Albisola Ceramiche, Italy, 1970. Hand signed. Length 24 cm. Edition 2/100. (D) Ray-finned fish gar scale

(*Lepisosteidae*; G. Cuvier, 1825), Bartow, Florida, USA, Pleistocene, ca. 1 Mya. (E) Sand dollar *Encope tamiamiensis* (*Clypeasteroidea*), Tamiami Formation, Ochopee, Florida, USA, Miocene, 5-24.5 Mya. (F) Gastropod *Turritella Agate*, Green River Formation, Wyoming, USA, Eocene, 45-50 Mya. (G) Marine reptile, *Keichousaurus hui*, Mudstone and silts of Guizhou, China, Size: 8.8 cm (11 cm in stretched position), Mesozoic, Mid Triassic, 245 Mya. (H) Dinosaur, handcrafted sculpture, natural malachite stone, Congo, 20th century. (I) Mammoth, *Mammuthus sp. tooth*, Nebraska, USA, Pleistocene, 1.6 Mya. (J) Mammoth-Elephant metal sculpture, 20th century. (K) Fossil bone scrimshaws. Mammoth carved scrimshaws and walrus carved tooth “Mystic whaler” (carved ca. 1842).

5. REPRESENTATION OF FOSSIL ENVIRONMENTS

Amber is also a key source for the study of the organisms present in fossil inclusions and their evolution with possible interactions (de la Fuente 2003, de la Fuente et al. 2024). The coexistence of multiple species shapes the ecosystem and fossil inclusions preserved in amber provide information to illustrate the environment evolving from Cretaceous, ca. 99 million years ago (Figs. 5A, 5B and 6A-6D).

Syninclusions represent amber inclusions with multiple organisms that coexisted with possible interactions with commensalism, phoresis and parasitism (de la Fuente et al. 2024, de la Fuente and Estrada-Peña 2026). For example, insect syninclusions in Dominican amber from Oligocene (ca. 25 – 30 Mya) include large, long-legged termites and tiny bees (Fig. 5A). The interaction between termites and tiny bees can include commensalism with bees nesting in termite mounds and parasitism with termites destroying bee nests.

Although amber syninclusions are a random process in most cases, the ant inclusions in Dominican amber (Fig. 5B) not only reflect coexistence with possible interactions with other insects, but also the origins of altruistic disease signaling in ant colonies (Dawson et al. 2025). As reflected in the study by Dawson et al. (2025), these interactions between ants may reflect the evolution of a signaling system in which infected ants trigger pupal signaling for sacrifice contributing to whole-colony health.

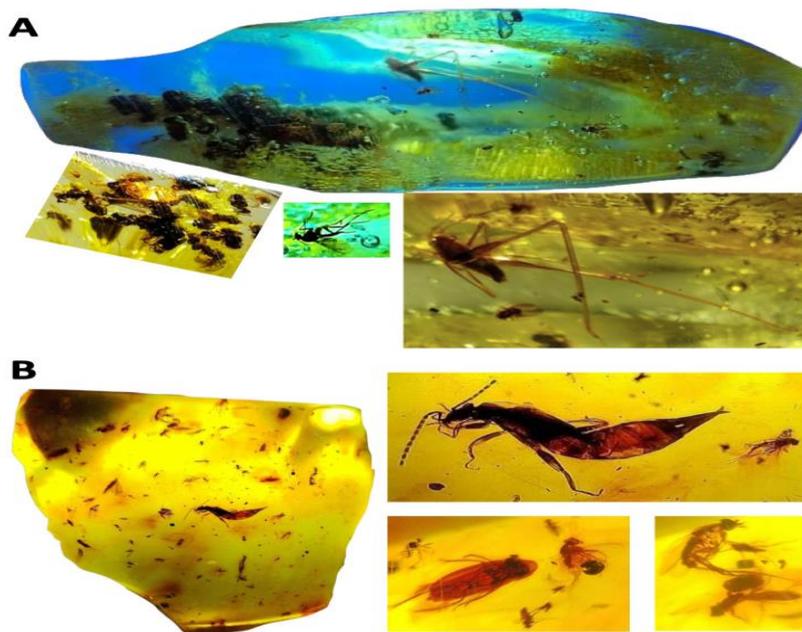


Figure 5. Amber syninclusions in Dominican fossil environment. Insect syninclusions in Dominican amber from Santiago de los Caballeros, Dominican Republic, Oligocene (ca. 25 – 30 Mya). (A) Insects include large, long-legged termites and tiny bees. (B) Insects include earwig, winged insects, termites, mosquitoes, ants and tiny bees.

Fossil evidence of the interactions between different organisms through evolution can also provide information of predation and intermediate hosts for parasitic organisms (Figs. 6A-6D). Based on fossil evidence, we can consider that the trilobite was bitten by a predator, probably an Arthropoda, *Anomalocaris* (Whiteaves, 1892) with recovery after the bite as shown by the presence of pleuron with a new border (Fig. 6A). Possible parasitic interactions are found in Burmite inclusions (Figs. 6B-6D). Syninclusions with a grasshopper and feather rachis from birds or dinosaurs support the coexistence of insects and vertebrates with possible predator-prey bird-grasshopper interactions (Fig. 6B). Scorpions

(Scorpiones; C. L. Koch, 1837) are predatory arachnids with insects as primary feed (Fig. 6C). Then, although mites were parasites on birds and feathered dinosaurs (Fig. 6D), grasshoppers themselves are not parasites but act as intermediate hosts for parasitic organisms that infect hosts such as feathered dinosaurs after consuming grasshoppers containing these parasites (Fig. 6B).

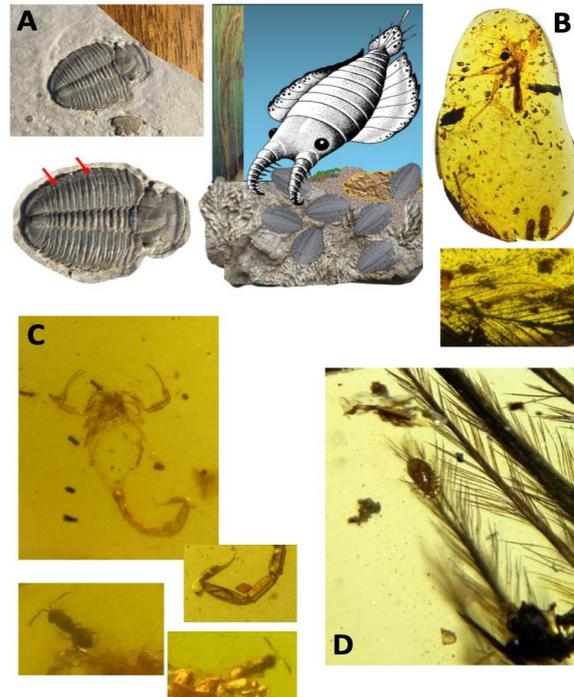


Figure 6. Predatory and parasite-host interactions. (A) Trilobite predation and recovery. Red arrows point at pleuron with a new border associated with recovery. Carboniferous fossil Crinoids and corals are included in the image. Credit, reconstruction of Anomalocaris, Richard Ellis / Science Photo Library (<https://www.sciencephoto.com/contributor/xxx/>). (B-D) Parasitic behavior in Cretaceous (ca. 99 Mya) amber from Hukawng Valley, Myanmar (Burma) with (B) Orthoptera insect grasshopper and feather rachis from birds or dinosaurs, (C) Scorpion with possible predation of an insect, and (D) Feather parasitic acari mite.

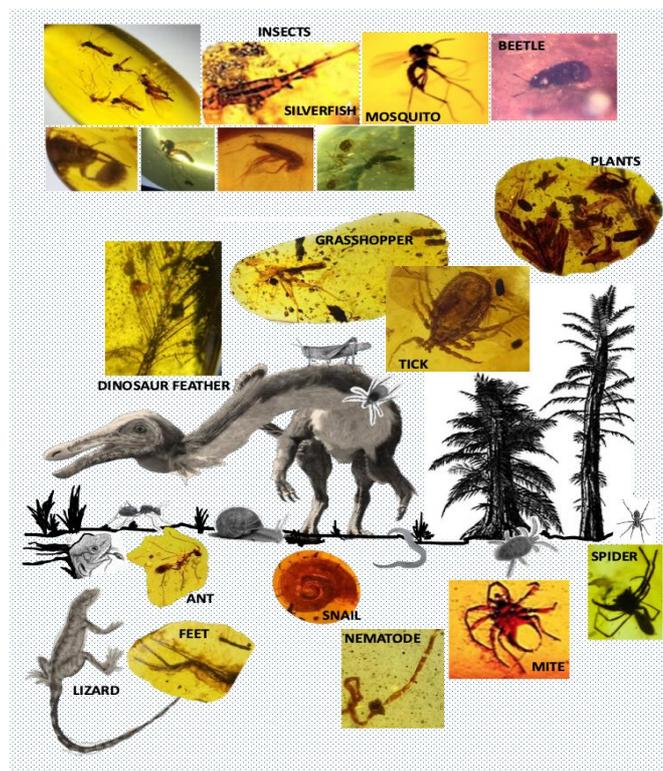


Figure 7. Cretaceous Burmese Park: Fossil environment in amber inclusions. Fossil amber inclusions include multiple insects, dinosaur, grasshopper, tick, plants, ant, snail, lizard, nematode, mite, and spider.

The information derived from amber inclusions can then be used to represent fossil environments. For example, in a Cretaceous Burmese park we can find in amber multiple insects including among other silverfish, mosquito and beetle with different habitats and diets, dinosaur feathers, grasshopper in syninclusion with the dinosaur feather, tick Ixodida extinct species, plant fragments, ant that may correspond to an extinct sp., *Gerontoformica tendir*, snail, lizard feet with large areas of scales, nematode, mites, and spider (Fig. 7).

6. MIGRATION, DIVERSITY AND COEXISTENCE WITH POSSIBLE INTERACTIONS BETWEEN DIFFERENT ORGANISMS

During the evolution, two major devastating mass extinctions occurred during the Permian-Triassic "Great Dying" and the end-Cretaceous event. The Permian-Triassic event was the most severe by reducing in approximately 90% of all life including insects. After, evolved new arthropod, plant and mammalian species among others. The migration of arthropods, birds, dinosaurs and plants occurred during the Cretaceous period (de la Fuente et al. 2015). Then, in the Eocene-Oligocene transition after end-Cretaceous extinction mainly caused by an asteroid impact, new species appeared and migrated in multiple regions. This is particularly reflected in ants showing possible physical with and without functional interactions with other organisms (Fig. 8).

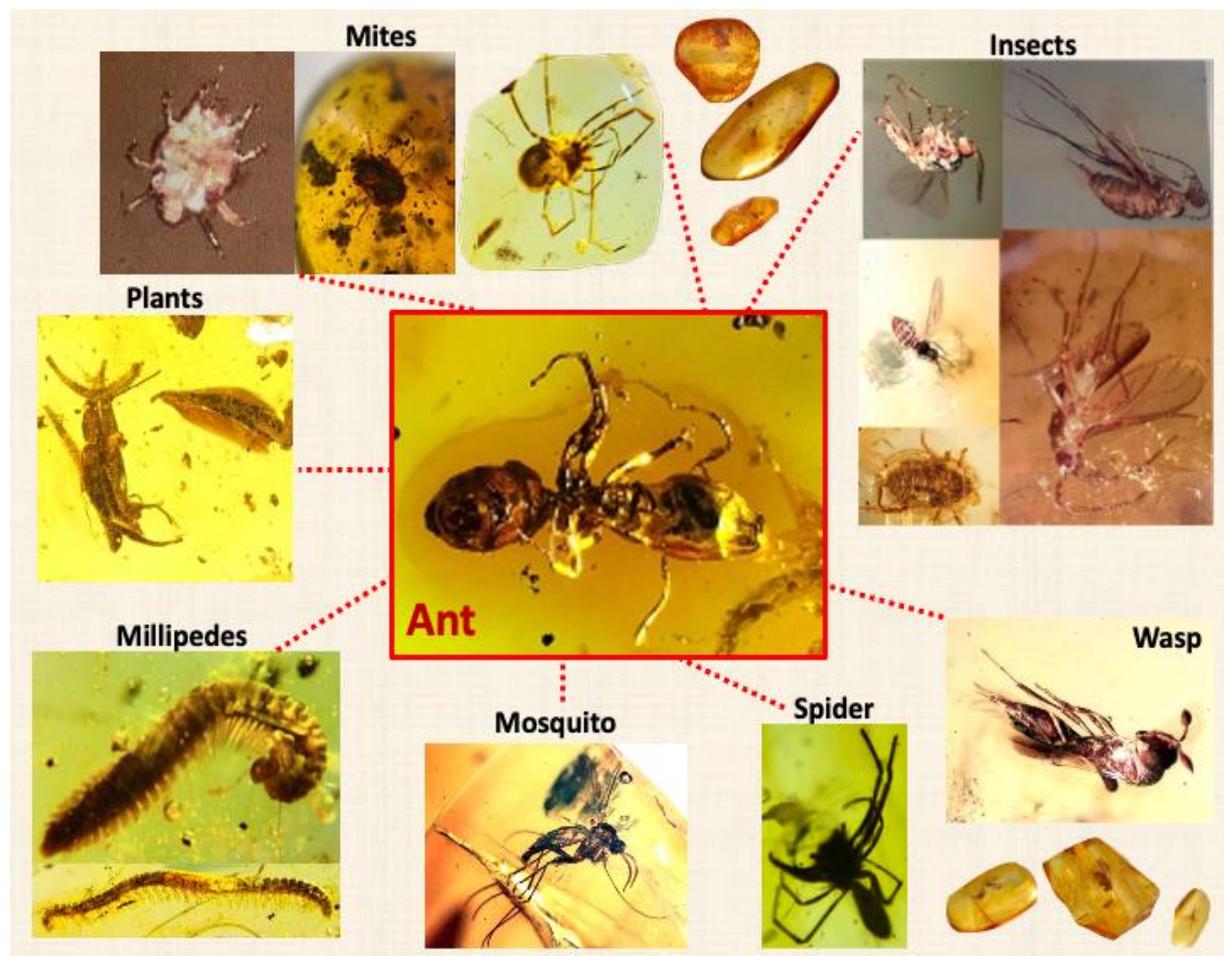


Figure 8. Representation in fossil amber inclusions of possible physical with or without functional interactions between ants and other organisms. Amber pieces were used to represent diversity at species and period levels. (a) Ant, Baltic, Lithuania, Eocene. (b) Mites from Baltic coast, Russia, Eocene and Burma, Cretaceous. (c) Insects, Dark winged fungus gnat *Sciaridae*, Billberg 1820, Baltic coast, Russia, Eocene, Gal gnats, Dominican Republic, Oligocene, Fungus gnat, Dominican Republic, Oligocene, *Circada* nymph, Baltic coast, Eocene. (d) Plant leaves, Baltic Sea, Ukraine, Eocene. (e) Millipedes, *Polydesmida*, Leach 1815, and *Chordeumatida*, Burma, Cretaceous. (f) Mosquito (or Wood/Fungus gnat), Dominican Republic, Oligocene. (g) Spider, Burma, Cretaceous. (i) Wasp, Dominican Republic, Oligocene.

Vertebrate species such as dinosaurs also migrated across Earth as evidenced by fossil coprolite from Madagascar, African predatory *Carcharodontosaurus* sp. (Stromer 1931) tooth and European Ichnogenus: *Gallator* ("stilt walker" in Latin; Hitchcock 1858) footprint in fossiliferous limestone (Fig. 9).

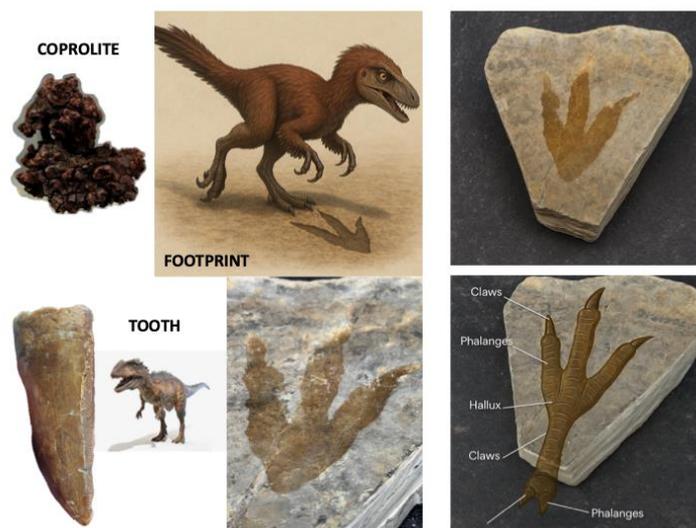


Figure 9. Dinosaur coprolite, tooth and footprint. Fossil coprolite dinosaur dung (7.5 x 4.1 x 5.5 cm) comes from Madagascar (Cretaceous, ca. 100 Mya). *Carcharodontosaurus* sp. fossil tooth (length 58 mm, width 22 mm, depth 28 mm, weight 95 g) from Kem-Kem Beds, Morocco (Cretaceous, ca. 100 Mya). Track from small theropods (footprint, 13 x 9.5 cm) Ichnogenus: *Grallator* in fossiliferous limestone from Mont Lozère region, France (Upper Triassic, ca. 200 Mya). This specimen exhibits a well-defined tridactyl (three-toed) impression with elegantly slender digits and a distinct heel pad, typical of agile carnivorous dinosaurs.

Fossil ammonites are extinct marine cephalopods with widespread distribution associated with their abundance, evolution and distribution due to connected marine environments during the Mesozoic Era (Cretaceous 66-145 Mya, Jurassic 145-201 Mya, Triassic 201-252 Mya) with extinction at 66 Mya (Zell and Stinnesbeck 2016, Yu et al. 2019) (Fig. 10).

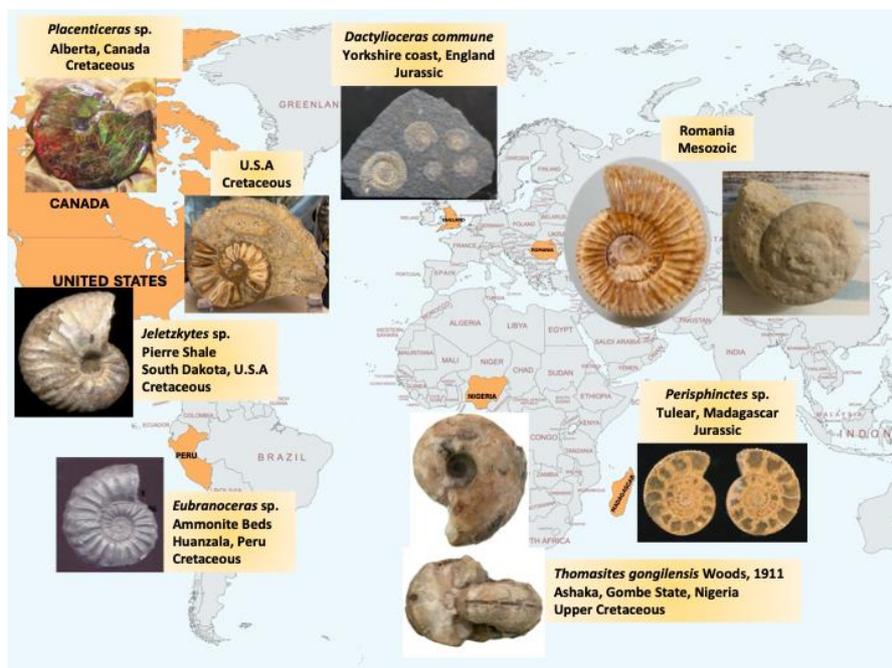


Figure 10. Ammonite biodiversity. Fossil ammonites are from different regions during Mesozoic Era (Jurassic 145-201 Mya, Cretaceous ca. 70, Upper Cretaceous 92 Mya).

7. PALEOART OF THE FOSSIL ECOSYSTEM

Paleoart (also spelled as paleoart or paleo art) creates artistic representations of prehistoric life based on scientific evidence of fossil remains and associated ecosystems (Ansón 2015, Lescaze 2017, de la Fuente 2023a, de la Fuente 2025c). These pieces can recreate fossil inclusions (Figs. 9 and 11) and use the fossil remains for ecosystem representations (Figs. 12-14). Although rare, represented fossil inclusions can be found in both fossil limestones and amber as shown for winged ants and beetles (Fig. 11). Some of the cultural representations of fossil organisms (Fig. 4) may by also considered in paleoart.

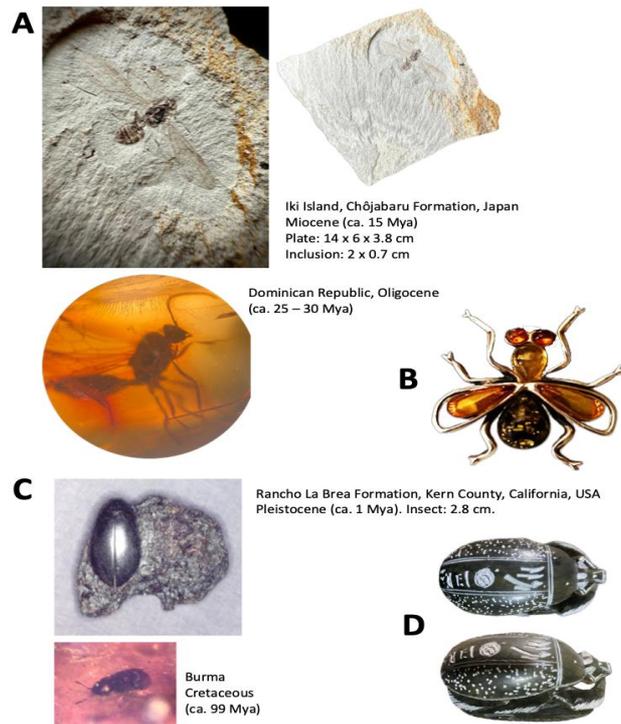


Figure 11. Paleart to recreate fossil remains in fossiliferous limestone and amber. (A) Winged ants, Family Myrmicinae, Cenozoic Era. **(B)** Winged ant representation in a Mexican jewelry 925 sterling silver brooch with amber from Simojove, Chiapas (Miocene-Oligocene, 5-38 Mya). Piece origin: “La Platería”, Tasco Mercado, Calle Liverpool, Mexico City, Mexico. **(C)** Beetles, Coleoptera, Pleistocene and Cretaceous. **(D)** Scarab beetle representation in Egyptian stone art, symbol of the sun god Khepri, rebirth, creation, and resurrection.

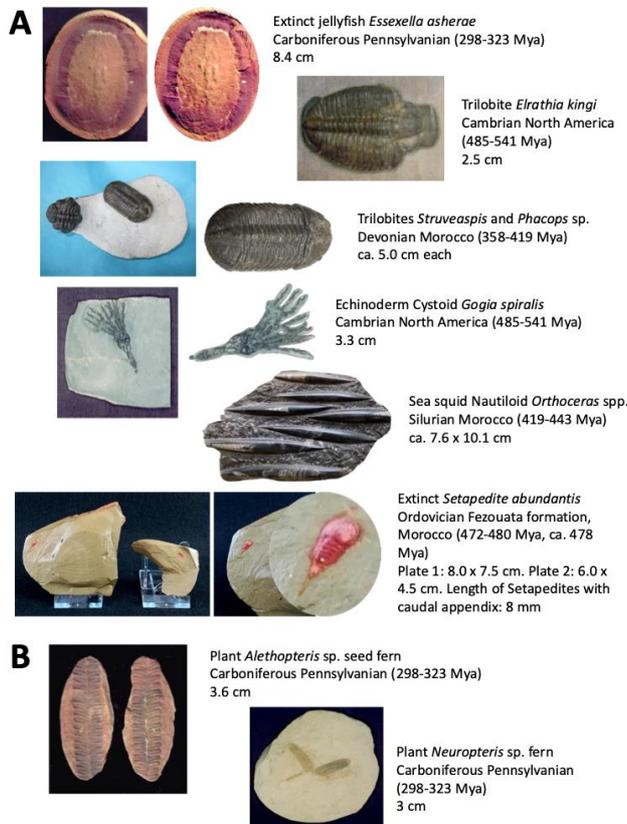


Figure 12. Organisms in fossiliferous limestones from Paleozoic Era. (A) Marine organisms, including extinct *Setapedite abundantis* from the primitive arthropod Chelicerate, group Euchelicerata as the earliest known ancestors of ticks, mites, scorpions, spiders, and horseshoe crabs (Lustri et al. 2024). **(B)** Plants.



Figure 13. *Paleozoic Park: Fossil environment in fossiliferous limestone. Fossil organisms in limestones are described in Figure 12.*

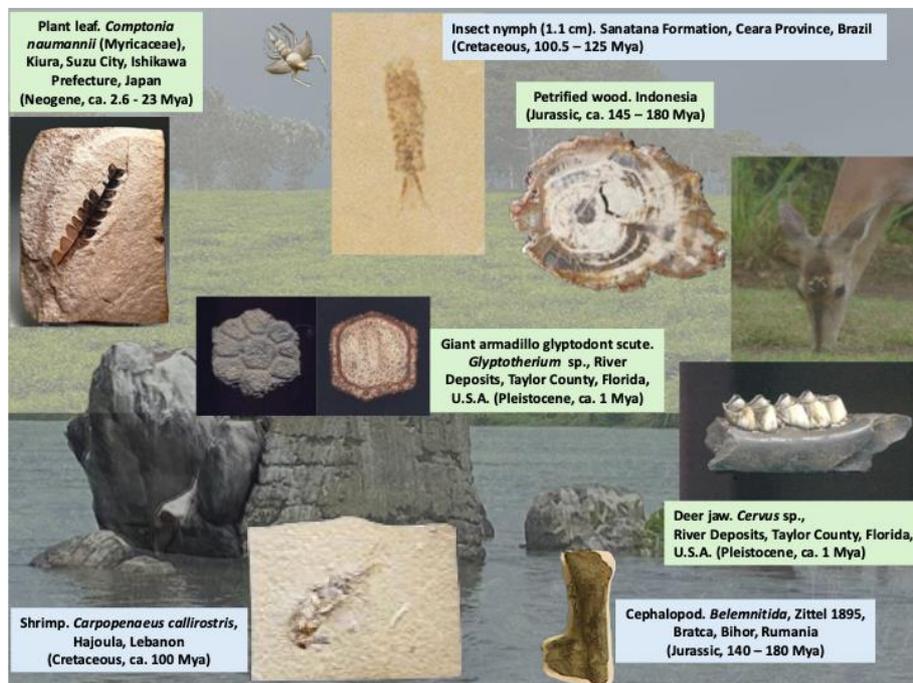


Figure 14. *Fossiliferous limestones with biodiversity. The organisms include plants, insect, crustacean, cephalopod and mammals.*

8. FOSSILS IN EDUCATION

Fossils in education are important for teaching the history and evolution of Earth, life and climate. As shown here, fossils represent cultures, environments and ecosystems. The students at different ages can learn through hands-on activities to recreate fossil inclusions and connect to past ecosystems (Figs. 15A, 15B). With these activities, students can integrate science, literacy, art and critical thinking to approach challenges associated with life and climate changes over time.

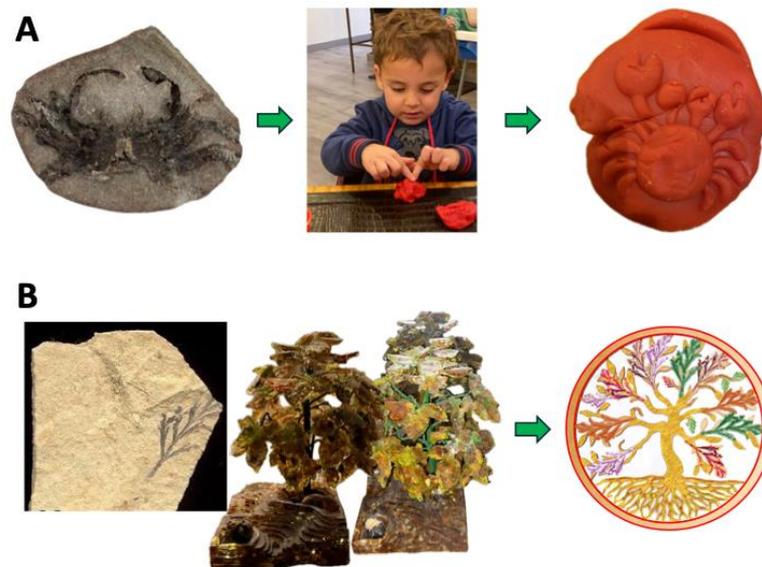


Figure 15. Hands-on activities to recreate fossil inclusions. (A) *Brachyura True* crab from Santiago de Chile, Chile (Late Cretaceous, ca. 90 Mya; also shown in Fig. 32) inspires a two-years old student to recreate the fossil with modelling dough. The student is de la Fuente's grandson, José Mauro Callejas de la Fuente. (B) A fossil plant leaf (Pliocene ca. 5 Mya, Creede Flora Mineral County, Colorado, USA; Dimensions of inclusion ca. 2.3 cm) and a hand-crafted bonsai tree with Baltic amber (Cenozoic, Eocene; Dimensions ca. 18 x 15 x 17 cm, 505 g) (de la Fuente 2025c). Each leaf has hand-picked amber pieces which are hand casted and attached, leaf by leaf, in the most pleasing to the eye shapes. According to cultural traditions, these bonsai recreate the tree of life and may bring you luck. This information was used by a university student (anonymous) to represent the tree of life.

Teaching activities include recreation of fossil inclusions through artistic representations such as hands-on digs and drawings, analysis of fossil collections and digital models, exploration of trace fossils to study animal behavior and ancient environments, and fossil creation using salt dough or clay to understand fossilization processes. Additionally, creativity can be motivated through integration of fossils in environmental representations with multiple natural and art pieces (Fig. 16).

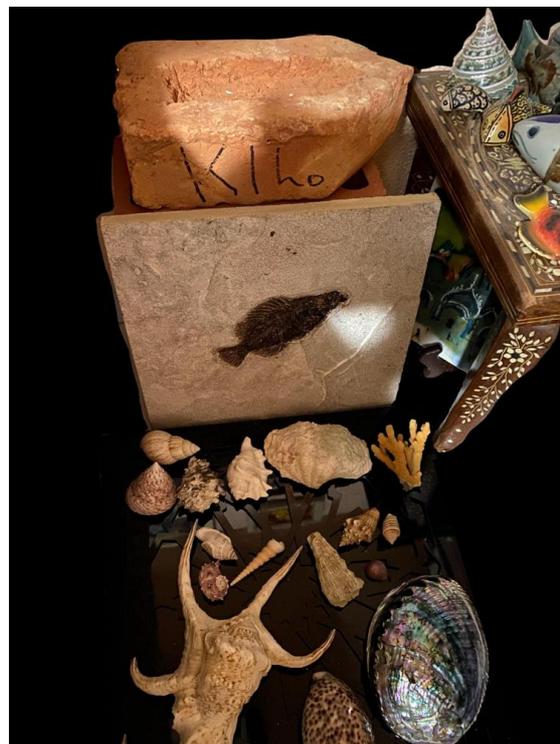


Figure 16. Motivated integration of fossils in marine environment. Fossil *Cockerellites predator* fish (Fig. 7) with natural seashells and seashells, fish ceramic representations and the clay boat sculpture "Vive y deja vivir" by Alexis Leyva Machado (Kcho), 2006.

9. CONCLUSIONS

The multiple approaches for the study of fossils in art and science can be integrated to obtain information for a better description and analysis of the origin and evolution of modern organisms with their environments and interactions (de la Fuente 2003, Nava et al. 2009, Chitimia-Dobler et al. 2023). The study of fossils is also relevant for education and communication. For example, by using fossil inclusions in both amber and fossiliferous limestones, it is possible to support the phylogenetic evolution of different organisms and in different regions of origin for fossil inclusions (Figs. 17 and 18).

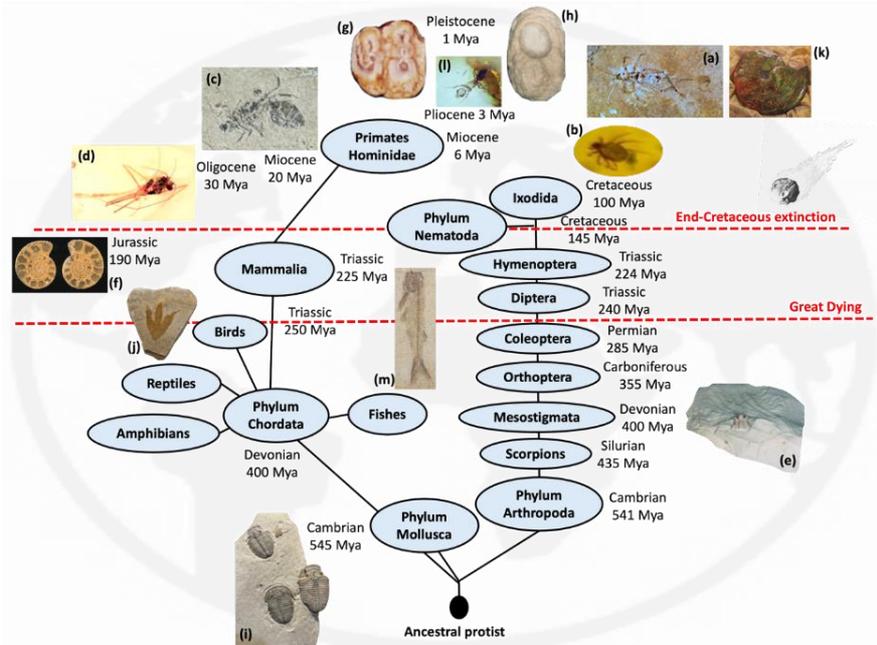


Figure 17. Morphological and molecular phylogenetic tree of organism’s evolution. Representative fossils include: (a) Grillo in Brazilian Santa Ana Formation fossiliferous limestone (Cretaceous, ca. 92-120 Mya), (b) Tick in Burmese amber inclusion (Cretaceous, ca. 99 Mya), (c) Dragonfly (*Libellula*) in South Italian fossiliferous limestone (Miocene, Mya), (d) Aquatic midge in Dominican amber (Oligocene, ca. 25 – 30 Mya), (e) Trilobite (*Huntonia oklahomae* or *Cyphaspis carrolli*) in fossiliferous limestone from Oklahoma, U.S.A. (Devonian, ca. 410 Mya), (f) Ammonite *Perisphinctes* sp. in Tulear, Madagascar fossiliferous limestone (Jurassic, 145-201 Mya), (g) Manatee *Trichechus* sp. tooth in fossiliferous limestone from River Deposits Formation in Florida, U.S.A. (Pleistocene, recent-1.6 Mya), (h) Wasp nest *Leptop duponti* in fossiliferous limestone from Elliston, South Australia (Pleistocene, recent-1.6 Mya), (i) Trilobites in fossiliferous limestone from Millard County, Utah, U.S.A. (Cambrian, 485-541 Mya), (j) Dinosaur Ichnogenus *Gallator* footprint in fossiliferous limestone from Mont Lozère region, France (Upper Triassic, ca. 200 Mya), (k) Ammolite (*Placenticerus* sp.) from Alberta, Canada (Cretaceous, ca. 70 Mya), (l) Ant in Kenyan amber (Pliocene, 1.6-5 Mya), and (m) Chinese fish (*Lycoptera* sp.) in fossiliferous limestone from Laioning Province, China (Jurassic, 145-201 Mya).



Figure 18. Map of the origins of fossil inclusions included in the KGJ Collection. Countries of origin for fossil limestones and amber are highlighted in red and blue, respectively. World map was created using MapChart

(<https://www.mapchart.net>). Representative fossiliferous limestones from Green River, Bonanza, Utah, U.S.A. (Eocene, 38-54 Mya) containing a Crane fly (Diptera: Tipulidae) and a Robber fly (Diptera: Asilinae, *Asilopsis fuscula*, Cockerell, 1920 or *Asilus palaeolestes*, Cockerell, 1921) and from Santiago de Chile, Chile (Late Cretaceous, ca. 90 Mya) with a *Brachyura* True crab. Representative amber pieces have an insect wealth (ants, parasitic bees, flies, moths) and plants (Santiago de los Caballeros, Dominican Republic, Oligocene, ca. 25-30 Mya) and inclusions of ant and larva (Baltic Sea coast, Eocene, 38-54 Mya).

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