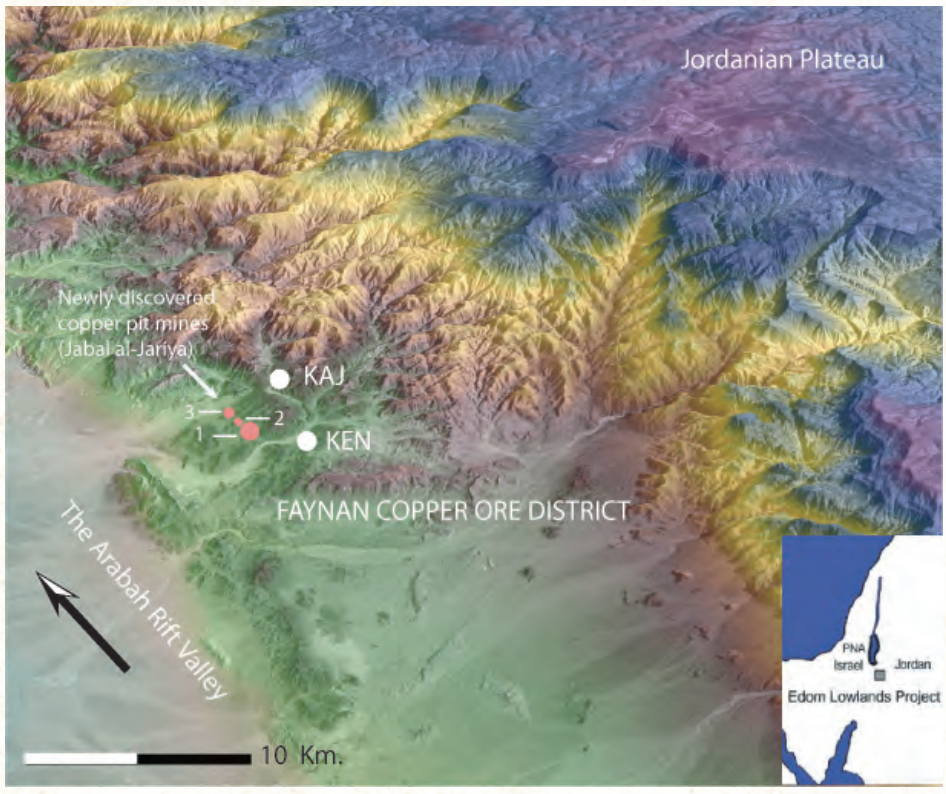
New Iron Age Copper-Mine Fields Discovered in Southern Jordan

One of the most productive approaches for assessing social and political change in the archaeological record is to trace the exploitation of natural resources in the past, its extent, and the techniques used. Despite more than a century of research in the Faynan copper ore district of Jordan—the largest such resource zone in the southern Levant—it is only recently that a survey team discovered an extensive cluster of the largest copper-pit mine fields. These were found hidden in three valleys in the northwestern portion of the Faynan region, below the western slopes of Jabal al-Jariya (JAJ). Here, we describe the finds and suggest that these mines be understood as part of the extensive early Iron Age (ca. 1200–900 B.C.E.) Faynan copper industry that has been investigated by our University of California, San Diego–Department of Antiquities of Jordan research team in recent years.

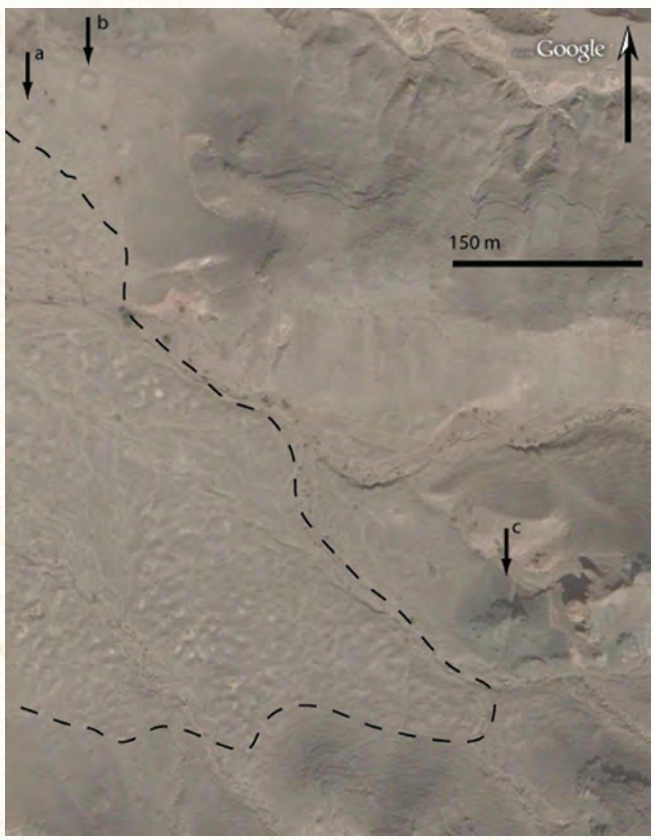
While conducting a regional archaeological survey of Iron Age trade routes between the copper-ore-rich Faynan region and the Edom highlands of the Jordanian plateau, our team identified hundreds of plate-like depressions, approximately seven meters in diameter on average, densely scattered in an enclosed valley of about thirty hectares that penetrated into an extensive gravel terrace at the base of Jabal al-Jariya (JAJ-1, 30.695°N, 35.430°E). The resemblance of the new Faynan mines to the plate-like features found in survey areas A, C, and G in Israel's Timna Valley (Conrad and Rothenberg 1980), about one-hundred kilometers to the south, as well as their geological location and association with copper ore deposits, clearly indicate that the newly discovered Faynan features are blocked pit mines that provided ore for nearby Iron Age smelting sites such as Khirbat en-Nahas and Khirbat al-Jariya. Tracking the prominent signature of the Faynan mine scars on satellite imagery available on Google Earth, we located two similar mine fields approximately half a kilometer (JAJ-2, 30.701°N, 35.432°E) and one kilometer (JAJ-3, 30.704°N, 35.435°E) to the north, sprawling over about one quarter hectare and one hectare respectively. We have named these mine fields from south to north JAJ 1, JAJ 2, and JAJ 3. In the Timna Valley, the previously "enigmatic" depressions were, until now, unique in the entire landscape of the Levant. The scarcity of archaeological finds in such mine fields and the exhaustive exploitation of ore made the interpretation of the "plate-like" features in Timna difficult, and only after years of research were they proven to be blocked mining shafts and pits (Rothenberg 2005).



This map shows the location of three newly discovered pit mine fields in the Faynan district of Jordan. The authors date them to the early Iron Age based on their proximity to the smelting sites of Khirbat al-Jariya and Khirbat en-Nahas, and on the density of other Iron Age sites found in this region. *False color satellite image courtesy of ROHR, Nicosia, Cyprus.*

A view looking toward the northwest of one of the copper pit mine fields (JAJ-1). The disturbed surface is densely covered with depressions marking the location of the ancient mining pits. The depressions are identified as pit mines based on the comparison to the well-studied mines in the Timna Valley in Israel. *Photo by T. E. Levy, UC-San Diego Levantine Archaeology Laboratory.*

The large plate-like depressions marking the location of the ancient pit mine, as in this view of the JAJ mine Field 1, have served as traps for bright wind-blown loess sediment that today enhance the visibility of the pits in contrast to the black dolomite rocks in the surrounding area. *Photo by T. E. Levy, UC-San Diego Levantine Archaeology Laboratory.*



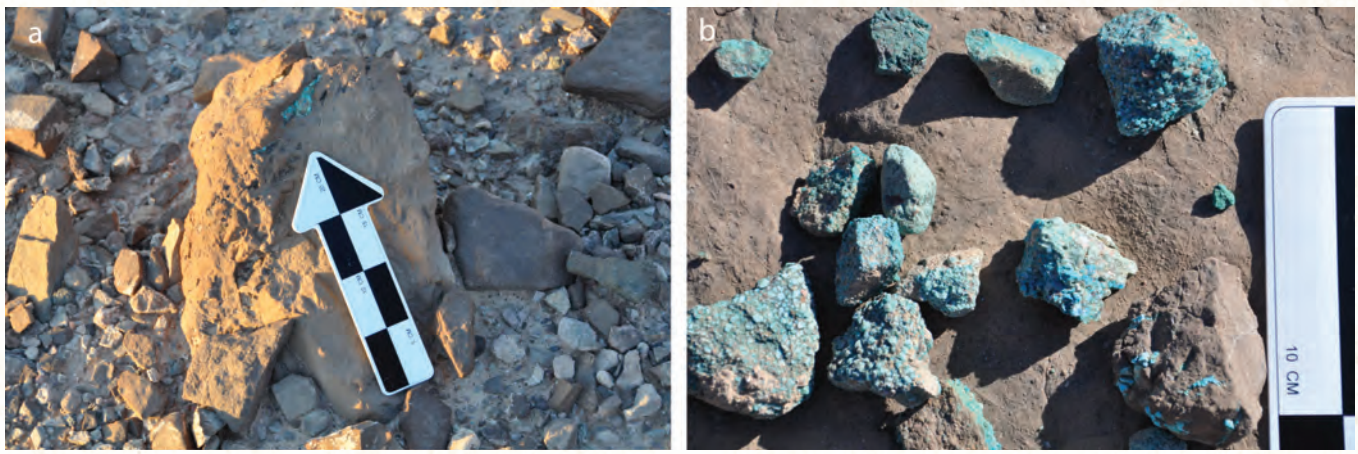
A satellite image of the eastern portion of Jabal al-Jariya copper-pit mine field (JAJ-1, delineated by a dashed line). A and B are two archaeological rectangular encampments; C is a magmatic plug, part of Phenerozoic magmatism exposed in the vicinity of all three mine fields. Image courtesy of Google Earth Pro.

We suggest dating the new mining areas presented here to the early Iron Age based on their proximity to the well-dated copper smelting sites of Khirbat en-Nahas and Khirbat al-Jariya of the same period. In addition, the lack of significant copper-related sites from other periods in the close vicinity of the Jabal al-Jariya mine fields (Hauptmann 2007) and the "Iron Age landscape" identified by Levy *et al.* (2003) in this region add further weight to this interpretation. These mines constitute one of the largest mining fields of the ancient Levant, and probably represent one of the most important Iron Age mining fields in the Faynan region. Our recent discovery provides an explanation for what has been until now a noticeable discrepancy in the archaeometallurgical evidence from Faynan and Timna: while Faynan has more evidence of Iron Age smelting activities, Timna had, until now, many more recorded mines (Hauptmann 2006).[1] With the new Jabal al-Jariya mining complex, our understanding of the scale and organization of mining and metallurgy during this period in southern Jordan is quickly changing.

The magmatic dyke, viewed here from the north, penetrates the Salib reddish sandstone and the black burj dolomite. This newly discovered evidence of Phanerosoic magmatism may be associated with rich copper mineralization in the lower Massive Brown Sandstone formation, now eroded and part of the colluvial terraces. *Photo by E. Ben-Yosef, UC-San Diego Levantine Archaeology Laboratory.*

The ancient pit-mine operations have dramatically changed the local landscape in this part of the Faynan district. Unlike the numerous Iron Age shaft and tunnel mines found by Hauptmann, Weissgerber, and a team lead by T. Levy and Mohammad Najjar in the region (Hauptmann 2007; Weisgerber 2003; Levy *et al.* 2003), the new pit mines are remarkably different. The pits were excavated into the colluvial slopes of the valleys in order to extract copper nodules eroded from the Cambrian ore-bearing Burj-Dolomite formation that accumulated in the gravels. The open pits were refilled with the gangue of the adjacent active mines to maximize the exploitation of the exposed copper-rich colluvium—a well-delineated and easily accessible source of naturally broken copper ore. A nearby post-Precambrian magmatic plug and associated north–south dyke of more than one and a half kilometers in length, the only Phanerozoic magmatism known in the Faynan region to date and first published here, may imply that the richness of the copper mineralization in this specific locale was influenced by this magmatic feature (Segev and Sass 1989). The large plate-like depressions marking the location of the ancient pit mine have served as traps for bright wind-blown loess sediment that today enhance the visibility of the pits in contrast to the black dolomite rocks in the surrounding area. The ancient mining pits also naturally collect surface runoff water during the winter, making the plate-like scars of the ancient mines suitable for small-scale gardening even in the extreme arid zone of Faynan. Evidence of horticulture activities pursued by local semi-nomadic Bedouin tribes exists in a few of these depressions today.

◄ Renegades exploit tin ore fragments from the gravel in this pit mine in the Congo by digging large pits similar in shape to the three-thousand-year-old blocked pits recently discovered in Faynan, Jordan. *Photo courtesy of Johan Spanner.*



Details of ore fragments: a) embedded in a dolomite rock from the Burj formation; and b) ore nodules from the lower sandstone unit. *Photo by T. E. Levy, UC-San Diego Levantine Archaeology Laboratory.*

Contemporary small-scale mining activities in the Bisie region of the Congo, recently reported on in *The New York Times* (Polgreen 2008), provide an important model for how pit mines may have functioned in Iron Age Jordan. Extraction of Congo tin ore was achieved from pits dug into gravel deposits. The disturbed terrace surface in the Congo show similar features to the three-thousand-year-old mine fields in both Faynan and Timna.The large mine fields recently discovered in the Faynan region should now be part of the scholarly discussion about the ethnogenesis of local social groups who carried out mining and metallurgy in Iron Age Jordan as well as an index for examining the developmental processes that led to rise, maintenance and ultimate collapse of local polities such as Edom, Israel, Judah, and other neighboring areas (Levy *et al.* 2008). In addition, these extensive mine fields should be factored into the assessment of the role of technological change and the exploitation of natural resources in the social evolution of Iron Age societies in the southern Levant.

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Note

1. Hauptmann's attempt to explain this discrepancy (2006: 128) demonstrates the difficulty scholars have had with the "missing" mines in the archaeological record at Faynan: "At Faynan the situation is different [from Timna]. Neither a comparable number of filled shafts nor a large number of tailings seems to indicate extensive underground mining. But this does not mean that the extent of copper exploitation was less than at Timna. The contrary is the case. The amount of slag produced at Faynan suggests metal production on the scale of several thousand tons over the millennia […] At Timna, the slag heaps indicate considerably less than this amount. There are two main reasons for the less visible evidence of ancient mining at Faynan. The first is the exploitation of ores at a greater depth, which led to more extensive underground mining activities. The second is that that exploited parts of the mineralization were backfilled so that not much of the waste was unloaded on the surface."

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