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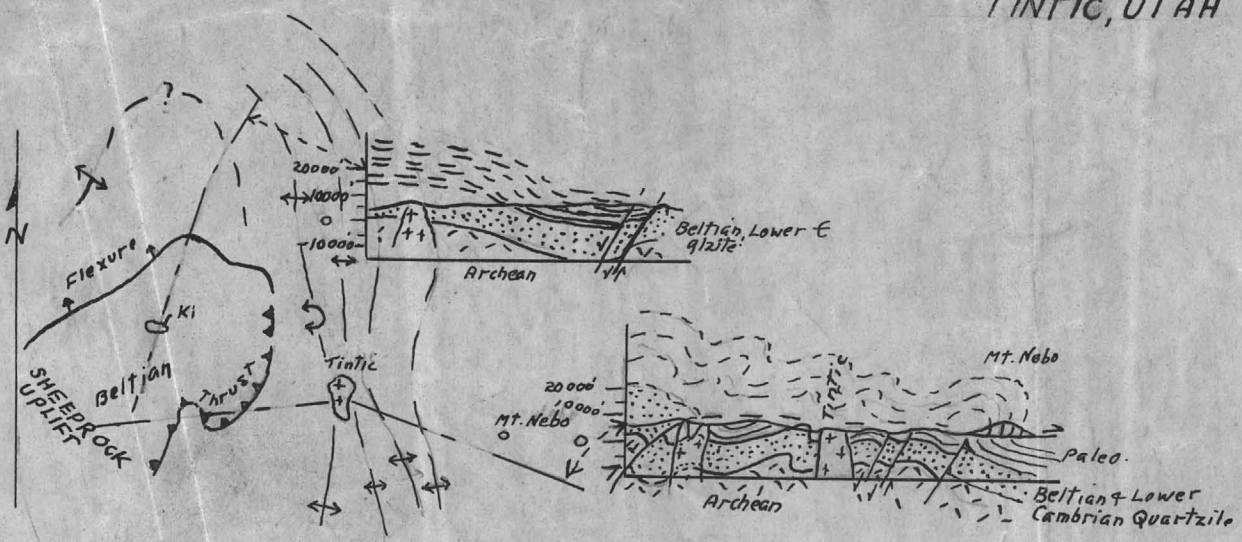
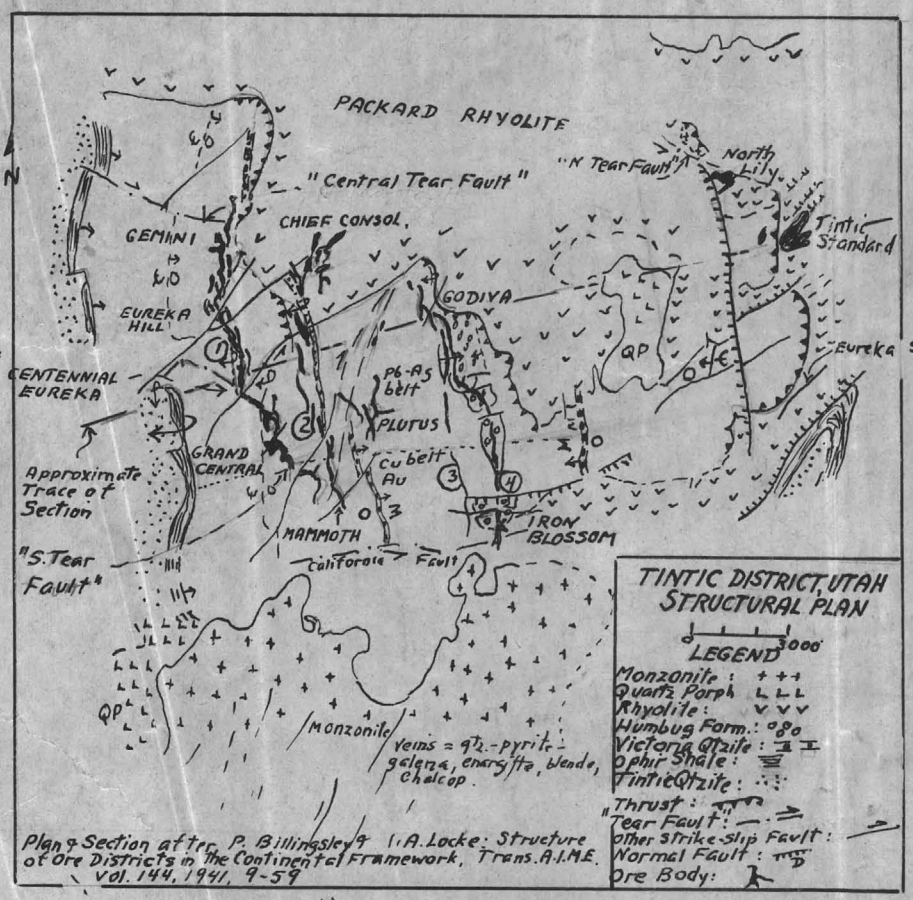
TINTIC, UTAH



REGIONAL SETTING

0 — 30 MI.

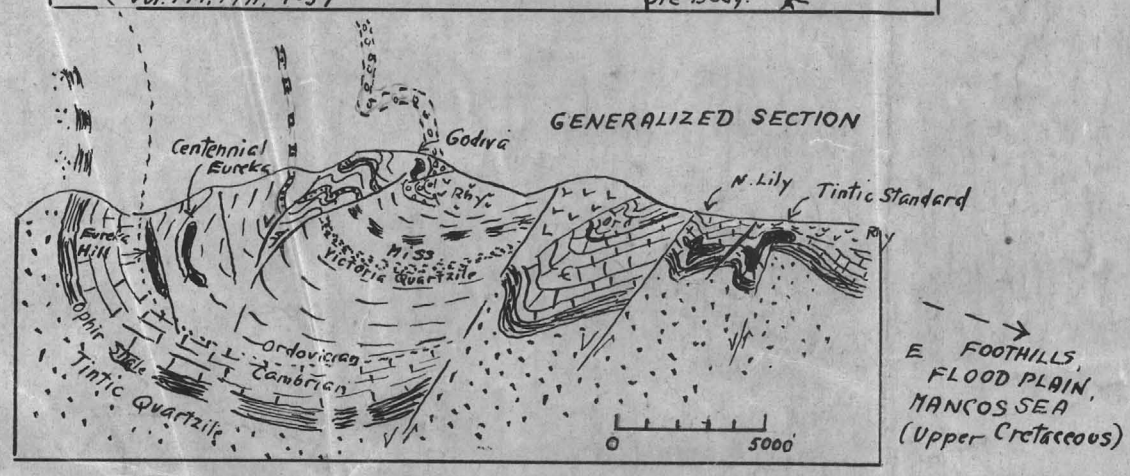
After A.J. Eardley: Structure of the Wasatch-Great Basin Region, Bull. G.S.A. vol. 50, 1939, 1277-1310.



N-S Ore Zones (Lindgren, USGS P.P. 107)

1. Gemini
2. Mammoth
3. Godiva
4. Iron Blossom

Plan & Section after P. Billingsley & I.A. Locke: Structure of Ore Districts in the Continental Framework, Trans. A.I.M.E. vol. 144, 1941, 9-59



E. Wisser 11/51

The Tintic Standard Mine

Ore Deposits Are Replacements in Limestone—How Selective Mining and Careful Production Accounting Increase Profits—Mechanical Equipment

By Arthur B. Parsons
Assistant Editor

before the mineralization, and the outcrops of the fis- Tintic Standard.

The generally accepted theory is that the mineraliz- smelter more than one class of ore; two classes were

(c) to make pipe lines as short as possible, because of

Opened by an air cylinder, the door is closed by a counterweight.

Typical labor distribution sheet

Labor cost per car in each working place is computed as a guide to the superintendent.

Fig. 3—Cost per ounce. The average figures represent the month to the date of calculation. In the lower pair the value of the lead is credited to reduce the cost of silver.

A look at geochemistry at work in a classic geologic district

Geochemical Studies in the Tintic Mining District

WILLIAM M. SHEPARD

SOCIETY OF

the workings). It was felt that the optimum pillar

nocrysts in the overlying volcanic rocks.

barite.

sanadine does not extend beyond the center of this

interpretation of the geochemical sampling results

SOCIETY OF

SOCIETY OF

Preparing Coal After Mechanical Loaders*

By Andrews Allen,† Chicago, Ill.

TINTIC

G.W. Tower Jr. & G.O. Smith: Geol. & mining industry of Tintic Dist. Utah. USGS 19th A.R. pt. 3, 1898, 601-767

p 112 # 8 W.Lindgren, G.F.Loughlin: Geoligy & Ore Deposits of Tintic District, Utah. USGS PP 107, 1919. Butler, Ore Deps. of Utah USGS PP 111, 1920.

9 P.Billinsgley, A.Locke: Structure of Ore Districts in the Continental Framework. TAIME 144, 1941, 16-21.

E-W Section, Deformation Plate II.

Production over $250,000,000, far larger than Goodsprings, Pioche, Frisco, Gold Hill combined. As-Pb-Cu-Zn-(Bi-As-Sb)

Section:	Miss.	Humbug ls., sh., ss.	300'
		Pine Canyon ls (ore)	750
		Black Shale	150
		Gardner Dol.	950
		Victoria qtzite	80
Upper Dev? Ord.		Dolomite, ls.	2500
	Camb.		
		Middle, dolomite	700
		" arg. ls.	900
		Ophir shale	350
Lower Camb (Beltian?)		Tinctic Qtzite	6000
			12680

Acted as semi-basement

According to Eardley, 10,000' Beltian qtzite below Tintic qtzite!
Not counting the Beltian qtzite, thickness about same as at Goodsprings.

Deformation was sufficiently intense so that this competent section, even the thock qtzite at the base, folded, with moderate ovetturning to the E, down slope. The higher, less competent Paleozoic rocks folded more intensely, forming sharp wrinkles on the broad, competent qtzite folds below. Folding tends to die out to the east, toward the shore of the Mancos sea, and is replaced by block-faulting, the stresses using the antithetic faults formed by the uplift to the west, as synthetic faults for uplift on the E, exactly as in N part of Gold Hill district. Pioche, Muddy Mts, Goodsprings

11/19/54

Seems to be a law: original folding involves up-flexing, formation of slump folds down flank of uplift, and when rock is work-hardened, antithetic faults dipping into core of uplift. Then when tendency for uplift jimps E, the se faults utilized as synthetic faults, footwalls shoved up wi

INSERT ORE DEPOSITS.

Simple N or NE fissures in monzonite,short, numerous,steep sheeted zon zones.Py,galena,enargite,very minor ccpy,ZnS,arsenop. Gangue qtz.,barite. HT alteration,whole north end monzon.more or less altered. Silic.,next fissure,sericitiz.oitside,pyrot.Still farther,chlorite,epidote,calcite.

Chance for porp.Cu?Lindgrem thought too low-grade,1918. At least DD Ho Big block may average 0.5% Cu.

Ore Deposits in Seds.1st phase,replacement of ls & dolo.with silica, barite,disem.pyrite,galena,enargite.All but massive sulph.ores siliceous,gangue qtz.,barite. Lindgren thought 1st stage was replacement by gelatinous silica,disem.galena,blende. Colloid then crystalliz ed to chalcedony and fibrous qtz. Diffusion bands,colloidal banding. Jasperoid s.t. compact,no 2nd phase mineraliz.Elsewhere,shattered,abundant cavities. 2nd phase: barite plates.more abundant than in 1st phase;white qtz,drusy;large am(ts.ore minerals,esp,galena.

Main ore minerals replaced jasperoid and dep.in cavities.

without folding;stress essentially the same with both types of deformation

Syncline shown on Section 4 mi.wide.,with a narrower anticline on the l

With true compressional folding synclines and anticlines should be equally compressed;but here synclines are open,anticlines tighter;both equally overturned to E.

According to Billinsgley & Locke,

While the major syncline trends N-S,the minor wrinkles trend NE.They correspond closely to the NE faults shown in the plan,which are tension f fissures.Steep NW to E-W strike-slip faults are tear faults connected with the overturned folding (Cf.Goodsprings).

Earliest intrusive was monzonite,as a big stock in the spoon of the syncline,which plunges N;appears also in places, part,along thrust strand Cf.Ely.. QP later.

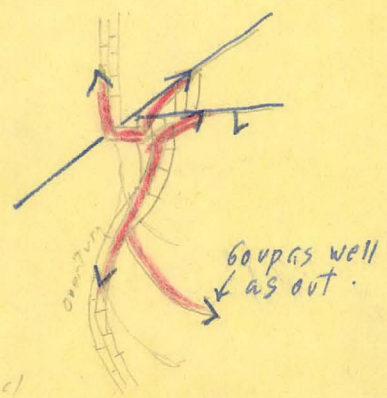
INSERT Localization of (B&L) Ore bodies at intersections of NW to E-W tear faults and NE wrinkle-thrust zones,which are NE tension fissures,apparently,in the basement.?

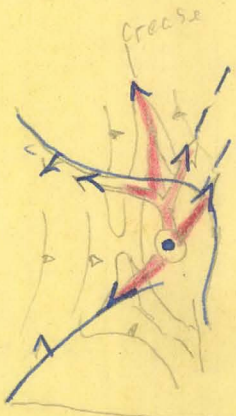
"These wrinkles are most strongly developned at shallow depth and in those parts of the stratigraphic column where strong and weak members are superimposed,such as quartzites,overlain by thin limestones and shales."

Heterogeneity of rock section.

11/28/51

4/19/54





QP, pebble dikes(QP matrix and crushed qtzite with pebbles of all deep rocks) and alteration (Dolomitiz.,silicif.,pyrit.) closely tied up with the ore clusters which coalesce to roots in depth showing porph.and pebble dikes there Alteration spreads as halos upward.

Tintic Standard

Centennial Eureka

Chief Consol. Similar

Thus the ore made out along wrinkles in the highly folded heterogeneous skin above small roots,generally fault intersections,in the qtzite "basement". In the competent though folded skin the ore made out laterally and upward.

The syncline plunges north;very likely given this,tilt by shoving up of monzinite stock on the south.Marginal faults along N,stright edge of stock with movements up dip (PP 111,p.403). Also some shoving of blocks N from monzonite.p.402:"There is evidence that other faults,of greater displacement than those just mentioned,were formed by the upeard pressure of the risong monzonite magma and were largely obliterated by the 'stoping' action of the magma,which reduced the fault blocks near the fault lines to groups of large intrusions in monzonite...the monzonte stock made room for itself prinacipally by hthrusting apart and faulting away the adjacent rock masses and to a less extent by 'stoping'".

Here again as at Good Hill is a stock asdending by pre-intrusion or intra-intrusion faulting. Competent qtzite produced faulting rather than doming.

While B and L emphasize ontrol along their tear faults,the N-S trend of the OBs is very evident andwas stressed by older writers. ~~N contact of stock was probably the ore channel,major;ore made out N along wrinkles inthe brittle qtzite to B & L points of intersection,then up and outward as funnels~~. Lindgren,USGS PP 107, describes 4 N-S ore zone,shown on the plan.Thinks zones along N-S inconspicuous fractures,nearly vert.,in overturned part of syncline,mainly,where these fractures follow in part very.beds. But to E,beds nearly flat'same N-S course along steep fracture.

11/24/52

I believe the 4 ore zones to be mantos like. No.4,Iron Blossom, stoped almost continuously for 8000',ave.width 100'.max.ht.150'. A manto goes where it likes with minimum structural control.See Basil Prescott: Underlying principles of the ls.replacement deposits of the Mexican province. EMJ vol.122, 1926,246-253,and 289-296.

Lindgren cites typical manto performance: "..where an ore body passes from one fissure to another ,the first fissure is usually barren beyond the point of departure."p.128. U-shape:

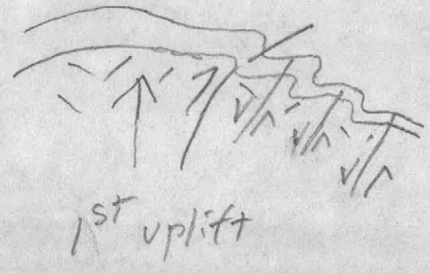
Other ore zones - strong of prds, ± more like B+L.

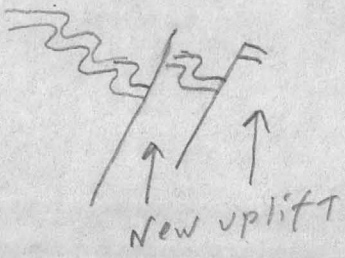
Show Lindgren, USGS PP 107,Plates 35,36,Plan and Section of 4th Ore Zone.

Summary of Tintic: Down slope of an major uplift,where beds accutely folded. But section mainly limestone,with competent Tintic quartzite and underlying Beltian able to fracture as well as fold,providing channels for magma as well as ore solutions. Tintic Section shows evidence that uplift along N-S lines took place after Sheep Rock uplift with which the folding was associated. Further,as Structural Map of Sheeprock-Wasatch Region shows,evidence for Tintic E-W axis, also later than the folds. Tintic stock came up along this axis;its N contact may have been main channel for ore solutions,which on nearing the then surface made out to the north,following N-S fractures and sharp crinkle folds & whatever else they could find. Cross-faults (roughly E-W) also contributed to ore localization.

Solutions asdending up relatively few trunk channels in basement reached horizon of light load.Undoubtedly flank of uplift was highland being eroded at the time.:Spieker Block Diagram A. Deformation doubtless still going on;but limit of folding reached,rocks,mainly ls.,faulte

Tintic is first clear example of the necessity of a combination of structural features to make a major ore district. (1) Faults and folds of brittle rock associated with Sheeprock uplift;~~(2)~~ mainly longitudinal and ctoss faults. As shown in the Tintic Section,folding here actually aided ore localization;many ore bodies along nearly vetyical beds, bed planes lines of weakness,acted as vertical faults (2). Resumption of movement older N-S faults,indicating jump of uplift to E.





Goodsprings
Gold Hill
Tintic

GSA Bull. vol. 71 1960
p. 1948

the results of a few pumping tests. On the basis of known principles of ground-water occurrence in the area, this information was placed in four categories based on geology and topographic position. Each category in turn was divided into seven depth zones, and minimum, median, and maximum values for yield were computed for each zone. When this information was adjusted and placed in tabular form, it was possible to determine within certain limits the probable yield of a well drilled to any depth at any place in the Eastern Coal Field.

FRINGE-ZONE ALTERATION IN CARBONATE ROCKS, NORTH TINTIC MINING DISTRICT, UTAH

Paul Dean Proctor
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Roughly zoned hydrothermal alteration occurs in the folded and faulted Paleozoic carbonate rocks near the north fringe of the Tintic mining district. At least five types of alteration are recognized: dolomitic, argillic, jasperoid, calcitic, and productive. This resembles the alteration described by Lovering *et al.* for the East Tintic area.

Hydrothermal dolomite is the earliest and most widespread stage and decreases with increasing distance northward. Argillic alteration is least abundant and of local occurrence. A jasperoid stage of alteration occurs as replacements of carbonate rock, is less abundant than the hydrothermal dolomite, and becomes sporadic northeastward. Calcitic alteration includes the replacement and/or open space filling in carbonate rock by red hematite-impregnated calcite. Northward, orifices resembling former hot-spring pipes are partially to completely filled by this and other calcite types and aragonite. The calcitic stage mainly postdates the jasperoid stage. It lies north of the jasperoid masses and is more abundant. Iron, lead, zinc, and probable silver sulfides, minor manganese, and reported bismuth and gold characterize the last or productive stage. This is closely associated with the calcitic stage, although the gold and bismuth occur near jasperoid rock. Except for the argillic stage the productive alteration has the least known quantity of introduced materials. Although exact time dating of the hydrothermal alteration stages is not possible in this area, the sequence appears to be dolomitic, argillic, jasperoid, calcitic, and productive in a crudely zoned distribution pattern north of the main Tintic district.

OLIGOCENE MARINE—NONMARINE RELATIONS, COASTAL VENTURA BASIN, CALIFORNIA

D. L. Protzman, J. A. Carver, and E. D. Pittman
Dept. Geology, University of California, 405 Hilgard Avenue, Los Angeles, Calif.

Transition from the terrestrial environment of the Sespe formation to the marine environment of the Alegria formation is represented by a gradual facies change. The area of interfingering is characterized by 12 major lithologic units which consist chiefly of conglomerate, sandstone, siltstone, and mudstone. These lithic units lose identity within short distances both laterally and vertically.

The Alegria may be subdivided into two general facies: (1) brackish-lagoonal, characterized by oyster-bearing mudstone and siltstone; (2) littoral-shallow neritic, consisting of coarse- to medium-grained fossiliferous sandstone and conglomerate.

Petrographically there is no distinction between Sespe and Alegria sandstones. Point counts indicate that the sandstone is epidote-bearing (up to 5 per cent) lithic arkose (19–37 per cent feldspar) with an argillaceous matrix and/or calcareous or ferruginous cement. The average mean diameter, average mean deviation, and mean skewness of the Sespe and Alegria sandstones differ only slightly from one another. Compositions of the conglomerate and sandstone indicate a source area of igneous, metamorphic, and sedimentary rocks of probable Jurassic, Cretaceous, and Eocene age.

Red beds in both formations are considered to be primary. The red pigment originated in a warm

$\bar{4}$ morphology, it must be assigned to space group $I\bar{4}$, which it then shares with only one other mineral, nagyagite. The unit cell, whose dimensions are a = 7.11 Å, c = 6.20 Å, contains two formula weights of $Ca_2BAsO_4(OH)_4$. The structure was studied with the aid of intensity measurements made with a single-crystal diffractometer. Patterson syntheses were made for projections along the *c*, *a*, and [110] directions. The atomic numbers of the atoms are in the ratio As:Ca:O:B = 33:20:8:5, so that the Patterson peaks are dominated by the atom pairs containing arsenic as one member of the pair. Since there are only two arsenic atoms in a body-centered cell, one arsenic can be arbitrarily assigned to the origin. Then the major peaks of the Patterson syntheses are at locations of atoms in the structure. The structure, determined approximately in this manner, was refined by least squares and by two-dimensional difference maps.

The structure consists of As tetrahedrally surrounded by O_1 at a distance of 1.67 Å and B tetrahedrally surrounded by O_2 at a distance of 1.47 Å. Ca_1 is surrounded by four O_1 at a distance of 2.44 Å, and by four O_2 at 2.55 Å; Ca_2 is surrounded by four O_1 at 2.38 Å and four O_2 at 2.55 Å.

THE LEWIS THRUST SHEET IN THE SOUTHEASTERN CORDILLERA OF CANADA*

R. A. Price Vol. 71 P. 1947

Geological Survey of Canada, Dept. Mines and Technical Surveys, Ottawa, Ontario Canada

The fault that defines the base of the Lewis thrust sheet has a maximum stratigraphic throw of 25,000 to 30,000 feet. It has been traced for more than 200 miles along the tectonic strike of the Rocky Mountains of Alberta and Montana and has been recognized in fensters and boreholes over an interval of 25 miles across the tectonic strike.

The orientation and mutual relationships of folds and minor thrust faults within the thrust sheet indicate that a relative eastward displacement of the more northerly Flathead-Highrock Range salient has been superimposed on structures originating under relative northeastward displacement of the Clark Range salient.

The stratigraphic path followed by the Lewis thrust fault indicates that: (1) the fault selectively parallels specific stratigraphic zones over large areas; (2) transverse, tearlike "steps" in the stratigraphic position of the fault have resulted in the development of transverse monoclines in the thrust sheet; (3) pre-existing broad folds have been truncated locally; (4) the maximum displacement along the fault is greater than 40 miles.

The displacement of the Lewis thrust sheet resulted in substantial shortening and thickening of the sedimentary veneer above the crystalline basement of the eastern Cordillera and in a significant addition to the thickness of the M crust in the eastern Rocky Mountains.

RELATION OF GEOLOGIC SOURCE, DEPTH OF WELL AND TOPOGRAPHIC LOCATION TO THE YIELD OF WELLS IN THE EASTERN COAL FIELD, KENTUCKY

William E. Price, Jr.

U. S. Geological Survey, Ground Water Branch, 522 W. Jefferson, Room 310, Louisville, Ky.

Determining the yield of wells from data collected during a ground-water reconnaissance of a rural area where pumping equipment is primitive or not available for controlled pumping tests may present a real problem, especially where the yield of wells is controlled by several natural variables. The Eastern Coal Field of Kentucky, a rough, hilly region underlain by shale, sandstone, and coal of Pennsylvanian age, is a typical example. Reliable pumpage data are difficult to obtain, and the yields of wells vary widely because they are affected by geologic source, depth of well, and topographic location.

The information on well yields obtained during a reconnaissance of the area included reports of bailing tests and water usage by well owners, data on pumping equipment and depth to water, and

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TINTIC, UTAH

GEOLOGICAL PROJECTIONS UNDER VOLCANIC COVER, EAST TINTIC, UTAH

BGSA 62(5)p.1420

Paul Dean Proctor
U. S. Geological Survey, Eureka, Utah

[redacted]

TRANSACTIONS OF THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS [SUBJECT TO REVISION]

V-74

No. 1491-I. Issued with MINING AND METALLURGY, September, 1925.

DISCUSSION OF THIS PAPER IS INVITED. It should preferably be presented in person at the Salt Lake City Meeting, September, 1925, when an abstract of the paper will be read. If this is impossible, discussion in writing may be sent to the Editor, American Institute of Mining and Metallurgical Engineers, 29 West 39th Street, New York, N. Y., for presentation by the Secretary or other representative of its author. Unless special arrangement is made, the discussion of this paper will close Nov. 1, 1925. Any discussion offered thereafter should preferably be in the form of a new paper.

UNIVERSITY OF CALIFORNIA DEPT. OF MINING AND METALLURGY

Notes on the Geology of East Tintic

By G. W. Crane, Salt Lake City, Utah

(Salt Lake City Meeting, September, 1925)

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University of California
DEPT. OF MINING & METALLURGY

[redacted]

One of the most striking, though minor, differences between the camps of Tintic and East Tintic is the character of the surface formations.